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THE Practical Medicine Series

COMPRISING TEN VOLUMES ON THE YEAR'S PROGRESS
IN MEDICINE AND SURGERY

UNDER THE GENERAL EDITORIAL CHARGE OF

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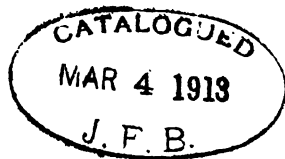
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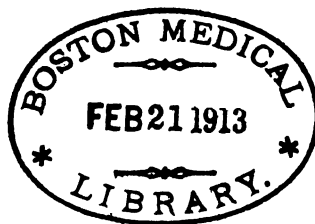
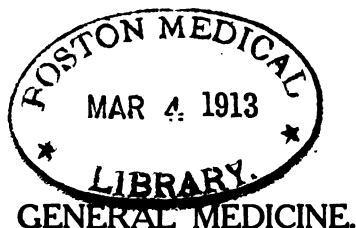


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INFECTIOUS DISEASES.

IMMUNITY AND VACCINE THERAPY.

General Principles of Immunity. To understand the recent literature on vaccine therapy, it is necessary to have a clear conception of the theory of immunity, especially of the side-chain theory proposed by Ehrlich and its applications and modifications made by recent authors. In brief the side-chain theory of Ehrlich supposes that the cell is possessed of the power of attaching to itself various molecules by means of groupings which combine with the molecules of various substances in such a way as to form a new molecule which may be either useful to the cell as in the case of food, or injurious to it as in the case of poisons, or may be of an indifferent character as in cases in which a toxin molecule is neutralized by a corresponding antitoxin molecule. The theory also supposes that pathogenic agents like bacteria are capable of throwing off substances which have the power of attacking the cell and combining with it in such a way as to destroy the vitality of the cell. These toxin-molecules are supposed to contain two groups, a haptophore group which has the power of seizing or combining with other groups and a toxiphore group which exerts a poisonous action. In response to the action of bacterial and other toxins the cells or at least some cells are capable of producing several classes of substances, all of which, however, act in similar ways on the bacteria or on their toxic products.

The simplest form of action is by means of antitoxins which are capable of uniting immediately with the toxin to form indifferent substances. The action of antitoxins is of a chemical nature and quantitative in its extent. Thus a given amount of antitoxin will neutralize a cer-

tain amount of toxin and no more. Antitoxins are, however, harmless to the organism which has produced them or to similar organisms. They are specific; that is, the antitoxin for diphtheria neutralizes only the toxin of the diphtheria bacillus. The toxin of tetanus is neutralized only by the tetanus antitoxin produced by the organism in response to injection by the toxins of the tetanus bacillus. Antitoxins have a close relation to proteid substances and are either a modified form of serum-globulin or are so closely attached to serum-globulin molecules that they are precipitated along with the globulins. In this way an antitoxic serum can be concentrated and the antitoxin obtained in solid form, as in the case of the powdered tetanus antitoxin. Antitoxins are the basis of the serum treatment of infectious diseases and their injection confers what is known as passive immunity.

The presence of bacteria or other foreign cells in the tissues of an animal leads to the production on the part of the animal organism of substances having a tendency to separate or destroy the bacterial cells and to assist the leukocytes in receiving them into their substance and destroying them by processes of digestion. The simplest of these actions is the agglutination of bacterial cells, a process by which the cells are made to adhere together and in this form to become separated from the fluid in which they are found. In the case of motile bacteria agglutination is preceded by a cessation of the motion of the bacteria and appears to be the first indication of a loss of vitality on the part of such bacteria. Agglutination is due to the presence in the blood-serum and other liquids of a substance or substances capable of causing the bacteria to adhere together. This property, as is well known, is the basis of a number of diagnostic reactions such as the Widal test for typhoid fever, the test for bacillary dysentery and similar tests for glanders, Malta fever, etc. In the application of these tests it is to be remembered that normal serum possesses a certain degree of agglutinating power due to the presence of common or non-specific agglutinins. The specificity of the test depends on the presence of specific agglutinins which as a rule are more powerful than the common agglutinins and can act at higher dilutions. The agglutination is

also a chemical reaction and the agglutinin is removed from solution by the addition of a sufficient amount of the organisms which are agglutinated by it.

Precipitins are substances produced by the introduction of various foreign proteins and have the property of precipitating other solutions of the same proteins. The reaction is specific and the precipitin which has been produced by the injection, for instance of the blood-serum of an animal of one species, will act only on the blood-serum of an animal of the same, or in some cases on the blood-serum of an animal of a closely allied species. Thus the precipitin produced in response to the injection of human blood-serum will precipitate the blood-serum of man but not that of the dog. Precipitin active against human blood-serum is, however, found to be active also against the blood-serum of the ape and *vice versa*.

Cytolysins. When cells such as blood-cells, kidney-cells or other organ-cells are injected into the blood or tissues of another animal, especially an animal of another species, a reaction occurs by which these cells are destroyed. This reaction is known as cytolysis and is brought about by the production of a substance capable of destroying cells of the particular kind under the stimulus of which it was produced. Thus a cytolysin produced by kidney-cells will destroy only or chiefly kidney-cells, and is as a rule specific for the cells of the same animal. The serum of an animal is cytolytic to a greater or less extent for cells originating in animals of another species. It is also sometimes cytolytic for cells of the same species, and in rare instances the serum of an animal is cytolytic for its own cells. The cytolytic (hemolytic) power may reside in the cells of one organ especially and may be exerted under normal physiologic conditions on certain cells which are of inferior worth or have been in some way damaged. Thus a normal hemolysis of worn-out red blood-cells occurs in the liver; an exaggeration of such a hemolysis may lead to a pathologic destruction of red blood-cells. According to some investigations the absence of inhibition of this process may have the result of retaining in the blood an excessive

number of erythrocytes. This is possibly the explanation of cases of polycythemia or erythrocytosis.

The process of hemolysis involves three factors: the hemolytic agent known as the hemolysin, the red blood-cell and the complement. The presence of all three of these is necessary for the occurrence of hemolysis. The hemolysin is known also as the hemolytic amboceptor, so-called because it is capable of uniting with both of the other factors involved in the reaction. The complement unites with the amboceptor and makes possible its union with the red blood-cell and the consequent destruction of the cell. Without the presence of complement, hemolysis cannot occur. A mixture *in vitro* of the hemolytic amboceptor, the red blood-cells, and complement constitutes what is known as a hemolytic system. Complement is present in all normal serums. It can be removed from such serum by certain agents (amboceptors) by a process of fixation so that it no longer can act as a part of a hemolytic system. In such a case mixture and incubation with red blood-cells produces no hemolysis because the complement has been fixed. This is the basis of the diagnostic reactions known as complement-fixation reactions. The best known of these is the test for syphilis devised by Wassermann. In the application of this test a substance capable of uniting with a syphilitic amboceptor is mixed with the suspected serum. If the serum contains syphilitic amboceptor a combination occurs between the antigen, the amboceptor, and the complement contained in the serum. This complement is, therefore, fixed, and can no longer act as a part of a hemolytic system. When, therefore, there is added to it washed sheep's blood-corpuscles and rabbit's serum in which the complement has been destroyed by the action of heat but which contains a hemolytic amboceptor that has been produced by the injection of sheep's blood no hemolytic action will occur because the complement has been destroyed in the rabbit's blood by the heat, and in the blood to be tested it has been made inactive by fixation with the syphilitic amboceptor and antigen. If hemolysis occurs in such a case it is assumed that no syphilitic amboceptor is present in the suspected blood, and hence no evidence

of the presence of syphilis in the person whose blood is being examined can be drawn from the reaction.

By a reaction similar to that by which cytolytins are formed the system endeavors to protect itself against invasion by bacteria by the formation of *bacteriolysins*. The lytic action is supplemented by an action of the white blood-cells known as phagocytosis. Phagocytosis is greatly favored or accelerated by the addition to the bacteria of a serum containing immune bodies. These immune bodies are believed to act on the bacteria in such a way as to make them more susceptible to the attack of the leukocyte. They are, therefore, called opsonins because they prepare the bacteria as suitable food for the phagocytic leukocytes. Phagocytosis results as a rule in the destruction of the bacteria inside the bodies of the leukocytes. It is believed that this is accomplished by a process of digestion. There appears to be in most serums a certain amount of common opsonins, but in addition there is present in serums which exhibit active immunity, a large amount of specific opsonins. The relation between the number of bacteria ingulfed by the ordinary leukocytes of the average healthy individual and the number which are engulfed by the leukocytes of the affected individual is known as the opsonic index. In general the opsonic index is low when the individual has poor resistance to the given disease. It becomes high with the progress of immunity, rising considerably above the normal. A low index, therefore, is generally held to indicate infection without immunity; a high index, infection with an active resistance.

Active and Passive Immunity. By passive immunity is understood the resistance to a disease imparted by the injection of immune bodies, principally antitoxins, derived from another organism. Passive immunity is attained by the employment of serum therapy, and is chiefly useful in diseases in which there is not a general invasion of the body by the organism but in which the symptoms are produced by the absorption of toxic substances produced in a local focus at which the bacteria are collected. The disease is a toxemia and not a constitutional or systemic infection. Active immunity is the immunity secured when immune substances consisting

chiefly of agglutinins, precipitins, opsonins, lysins, etc., are formed in the body of the infected animal. This form of immunity is acquired by the presence in the system of either the living bacteria or the dead bodies of the bacteria. In either case it seems probable that the active agent in calling forth the immunity is the toxin contained in the bodies of the bacteria which becomes soluble on the death and dissolution of these bacterial bodies. Active immunity is artificially produced by the injection of the dead bodies of the bacteria which is a form of vaccination but is not properly called serum therapy.

Vaccine Treatment. The principles of vaccine treatment have been elaborated chiefly by Sir A. E. Wright and are briefly as follows:—An infection, so long as it remains localized, excites little or no response on the part of the organism in general so that the blood contains small amounts or none of the immunizing principles. If the local powers of the infected organ are incapable of overcoming the infectious agent they either have succumbed to destruction by this agent or a condition of neutrality is set up in which neither party is able to vanquish the other. Such is the condition of most chronic local infections. For the cure of such infections there is needed first, a free circulation of blood through the affected part, carrying the immunizing agents contained in the blood of the general organism, and second, a stimulation of the general organism to the production of the immunizing bodies. The first requisite is realized in many cases by surgery in the shape of incisions or by the application of counter-irritants or the suction hyperemia secured by the method of Bier. These methods serve also in many cases to bring about a stimulation of the general organism by means of the products of infection which are forced into the general circulation. This process which results in an auto-vaccination of an uncertain but frequently beneficial character is frequently known as auto-inoculation. Such inoculation is followed by a depression of the opsonic index and usually by fever, and this condition is known as the negative phase of the reaction. Subsequent to this negative phase, the immune bodies are increased in the blood, the fever subsides and the opsonic index rises. This is recognized as the positive phase.

Since the auto-inoculation cannot readily be controlled, resort is had to an artificial inoculation by which the beneficial result is brought about in a very similar way. Artificial vaccine therapy, then, consists in the injection either of the toxins of the infecting agent or the infecting agent itself, sterilized by heat or by mechanical destruction. The trituration of the bacteria is followed frequently by filtration by which the undissolved portions of the bodies of the bacteria are separated from the preparation. The vaccine must be injected during the subacute or chronic stage of the disease. Vaccine therapy is unsuited to acute diseases because in those cases the auto-inoculation is sufficient to furnish a stimulus to the organism to bring out all its resisting power. It is possible that in some cases when the system has become insensitive to the continued stimulation by auto-inoculation, the introduction of vaccine from another source may be useful, but it is generally recognized that, as a rule, injections of vaccine in acute diseases cannot be beneficial and may be harmful.

The vaccine should be injected in the smallest quantity capable of provoking a beneficial reaction. Large doses tend to diminish the resisting power and to favor the extension of the disease. A second dose of vaccine must not be introduced until the negative phase of the reaction has passed. Disregard of this precaution tends to prolong a condition of lowered resistance. The determination of the point at which the negative phase has terminated and a second injection can be given is made by the opsonic index. Some authors, however, depend on clinical indications, as derived from the existence or non-existence of fever, the general condition of the patient, and the state of the local infection.

Preparation of Vaccine. Vaccines are of two sorts, autogenous vaccines and stock vaccines. The latter may be divided into monivalent, polyvalent and mixed. Autogenous vaccines are regarded as the best in the majority of cases. They are vaccines prepared by the cultivation of the bacteria which appear to be the causative agent in the case under treatment. This is done by determining what pathogenic organisms are present in the infected tissues or in the discharge from the focus of disease.

These organisms are then obtained in pure culture and a vaccine produced by uniting together the different organisms in the proportion in which they seem to be present in the original sample, sterilizing them and injecting. Stock vaccines are produced by the vaccine manufacturers by a similar method but necessitate the addition of some preservative such as phenol or cresol. A monivalent vaccine is one produced from bacteria derived from a single pure culture. A polyvalent vaccine is obtained by the mixture of bacteria from different sources, combining the different races of the same species. Mixed vaccines contain bacteria of different sorts which experience has shown are commonly associated in the production of certain diseases. In the treatment of infections it is frequently good practice to begin the treatment with a stock vaccine while waiting for the production of a suitable autogenous vaccine.

Anaphylaxis. Anaphylaxis is discussed by St. George T. Grinnan¹ who says that in order to understand the process of immunity or anti-anaphylaxis we must understand anaphylaxis, a condition which precedes immunity. Prophylaxis depends on anaphylaxis. The name anaphylaxis was introduced by Richet in 1904 and was used to define the condition of acquired or congenital hypersusceptibility of an organism to a strange protein or antigen with a reaction body formed in the body of the organism undergoing immunity. The substance must be protein in nature though not all proteins will cause anaphylaxis (*e. g.*, leucin and tyrosin). [Leucin and tyrosin can scarcely be denominated proteins since they are simple amino-acids; for instance, leucin is amido-caproic acid.—S.]

If we give a normal guinea-pig a sensitizing dose of 0.1 c.c. of horse-serum subcutaneously, intravenously, or intracranially, and after a period of from seven to nine days give this sensitized guinea-pig another dose in the same manner, the pig becomes very suddenly sick. He becomes restless, scratches at his nose and mouth and appears in great distress. His breathing becomes irregular, shallow and quick. He has convulsions and dies in so-called anaphylactic shock, the heart continuing to beat

(1) Jour. Amer. Med. Assoc., Jan. 20, 1912.

for some time after respirations have ceased. Had the pig survived the second dose, he would have been in a condition of immunity for the time being, and would have no longer reacted to a dose of the same serum. If after giving the first dose no more serum had been given, no symptoms would have resulted.

The period of incubation is the time that must elapse before the second or intoxicating dose will produce the characteristic symptoms. This period is from one to three weeks, after which the animal is sensitized or hypersensitive. The average time of incubation is ten days.

So effective is the process of this biologic phenomenon that if the horse-serum be dropped into the eye of the guinea-pig, it may be sensitized to a second dose in seventeen days. The experiments that have been made show that the toxic action is specific so far as the various serums are concerned. A guinea-pig sensitized with horse-serum is more susceptible to horse-serum than to cattle-, sheep-, hog-, or other serum. Anaphylaxis is therefore regarded as a specific reaction. •

Many different proteins have been used, including horse-serum, egg-, donkey-, sheep-, rabbit-, eel-serum and others. The serum first used by Richet was obtained from the tentacles of a sea anemone (actinia).

The toxic principles in the proteins resist the various physical and chemical forces that destroy. They are filterable through porcelain and are not destroyed by drying. Heating for two hours at a temperature of 130° C. does not destroy them. The poisonous action is not destroyed by chloroform, formaldehyd, tricresol (0.4 per cent.), alcohol or permanganate of potassium. Extracts of dried mummy and eighty-year old cow's placenta and blood dried for fourteen years, the cells being destroyed, were capable of sensitizing and producing anaphylaxis.

Extract of peas is quite as active as horse-serum. Guinea-pigs fed with horse-serum or horse-meat are susceptible to subsequent injections of horse-serum, and guinea-pigs fed with beef are susceptible to cattle-serum.

The poisonous principle in horse-serum appears to act on the respiratory system, or centers, the heart continuing to beat after respiration ceases. The poisonous ac-

tion has no relation to hemolysis; but the blood contains an acute poison entirely independent of any hemolytic action. It was first thought that in the case of diphtheria antitoxin, the antitoxin was the cause of the poisonous action, but it is now known that diphtheria antitoxin is entirely harmless and that the horse-serum is the sole cause of the poisonous action.

Of thirty-four deaths reported by Owens, following the injection of horse-serum (in the form of antitoxin), the majority were persons subject to asthma, or inherited a susceptibility to the odor of horses, or discomfort when in the neighborhood of a horse.

The following case is interesting as bearing on this point. A young man, aged 25, was a subject of hay-fever and occasional attacks of asthma. His brother was an asthmatic. So susceptible was the patient to the odor of horses that he was compelled to ride in a closed carriage or be made sick by the odor of the horses. Some children in his home contracted diphtheria. As a means of protection the young man was given antitoxin. In a few seconds he was in collapse and became unconscious and his respiration so embarrassed that it was thought that he was dead. After hard work, restoratives and artificial respiration saved his life.

In the case of asthmatics for whom the serum conveying antitoxin is so poisonous and in the case of those who have taken the serum before, some test of their susceptibility is of great value. Dr. August Callé has used and recommends a scratch test. The test is made in the same way as the von Pirquet test for tuberculosis. If a minute quantity of the serum be rubbed into a scratch in the skin and there follows a severe local or systemic reaction, its further introduction into the system in full therapeutic doses would be contra-indicated.

In cases in which there is danger from the use of horse-serum, atropin has been used by a number of investigators to modify the shock. Chloral hydrate, epinephrin and artificial respiration have given good results in a few cases, and have been useless in a large number of cases.

Rosenau and Anderson have pointed out the great similarity between anaphylaxis and the process that

takes place in tuberculosis. The tuberculin reaction is one of the best-known instances of anaphylaxis.

The hypersusceptibility of the tissue surrounding a tuberculous area assists in encapsulating and limiting the process. We see, therefore, that "resistance to disease may be largely gained through a process of hypersusceptibility, and that hypersusceptibility has an important bearing on the prevention and cure of certain infectious diseases or processes."

The mother guinea-pig transmits susceptibility to the toxic action of horse-serum to her young. This may throw some light on the hereditary transmission of tuberculosis. The fact that tuberculosis does run in families must, without doubt, be due to hypersusceptibility in a great number of cases.

The person who is hypersensitive to tuberculosis may, by the proper use of tuberculin, acquire immunity. By the wrong use of tuberculin in too large, or too often repeated doses, the beneficial hypersensitive state of the tissue may be exhausted or destroyed. Beginning the use of tuberculin, it should be given in such small doses as to develop and not diminish the power of anaphylaxis.

Hypersusceptibility may be easily induced in guinea-pigs with protein extract obtained from bacterial cells. The first injection is quite harmless, but the second injection of the same extract, after a definite lapse of time, is followed by a profound physiologic change which resembles the condition when horse-serum is injected. In certain cases the second injection is followed by immunity to the corresponding infection.

The connection between the toxemia of pregnancy and anaphylaxis is by some experimenters regarded as an established fact. Goodall of McGill University has reported three cases of sudden death in children after a copious nursing from an eclamptic mother. The manner and system of death were identical in all three cases. There was general depression, passing into coma and respiratory paralysis. The heart continued to beat after respirations ceased.

The toxic action of Jersey cow's milk on young infants is well known and probably finds its explanation in anaphylaxis. Egg albumin, which is so often used

when milk cannot be used, at times causes such severe anaphylactic reaction that discontinuing the egg albumin is necessary to relieve the condition.

It is necessary to understand clearly the difference between antiserums and vaccines in order to use these products. Antiserums, which contain antibacterial power, are elaborated in the blood of a horse. Vaccines are suspensions of dead bacteria in physiologic salt solution. The antiserum is a biologic germicide, and when injected into a patient conveys the protective substance produced by the horse. When the vaccine is injected the patient must by means of the vaccine produce his own protective bodies. It is clearly seen, then, that when a patient is overwhelmed with infection a vaccine will only do harm. Experience has shown this to be true.

In a general septicemia the serum is to be preferred, whereas in a localized or semilocalized condition the vaccines are better. Too large a dosage and doses given at wrong intervals have been responsible for much of the failure with vaccines. Furunculosis can be increased by a very large dose of streptococci. While the activity of the infecting agent is producing a negative phase the use of vaccine is clearly not indicated.

Relations of Anaphylaxis to Immunity. In an excellent article on anaphylaxis L. Hektoen² discusses the relations of anaphylaxis to immunity as follows:—The conception that introduction of microbes and their products induced distinctly protective reactions is seemingly not in harmony with the fact that an increased susceptibility seems to develop after introduction of all foreign proteins, whether cellular or in other forms. But this contradiction is only apparent. In the first place, there is, in most cases at least, probably no real increase in susceptibility—the actual degree of susceptibility to the same poisons being probably the same in the average normal and average sensitized animal; it is the power of reaction of the latter that is peculiar and for this reason “allergy” is perhaps the best word we have for the condition. Stated in the simplest way, we could say that the sensitized animal splits up a particular protein so rapidly that toxic substances are produced or set free in

(2) Jour. Amer. Med. Assoc., Apr. 13, 1912.

toxic quantities, while in the normal animal the process proceeds so slowly that no evident intoxication may result. Now in the case of microbes, lysis with splitting is not consistent with continued existence, and when small quantities are introduced as in natural infections, they may be killed in this way before they can multiply so as to furnish toxic doses of poison, and this would be immunity, either natural or acquired. The relations between antibacterial immunity and intoxication remains essentially the same as outlined by Pfeiffer. While he limited himself to the conception of preformed endotoxins, under the newer view we conceive the poisonous substances as being, at least in part, intermediary digestive products and as arising also in part from changes in harmless proteins. There is then no contradiction between immunity and allergy, which is a form of antibody reaction and, so to speak, an incident in the course of immunization.

From a study of the action of autolytic extracts in a sodic chlorid solution of virulent pneumococci it has been learned, according to E. C. Rosenow,³ that they become very toxic to normal guinea-pigs at a certain period during autolysis. Intravenous or intracardiac injections of from 3 to 7 c.c. produce symptoms and post-mortem changes in every way typical of anaphylactic shock obtained in sensitized pigs following the second injection of protein. The symptoms usually begin before the injection is completed, and death occurs in from two to ten minutes. Thus far, eight strains of virulent pneumococci have yielded this highly toxic substance. Early the extracts are only slightly toxic to normal animals, but very toxic to animals sensitized with extracts of pneumococci. At the end of from twenty-four to forty-eight hours at 37° C. (especially if ether has been added) or from four to ten days in the ice-box (without ether) they are very toxic to normal animals, but only moderately or not at all to sensitized animals, while still later they become quite harmless to both normal and sensitized animals. It makes no difference whether the cocci are washed or not, whether grown in broth or on blood-agar slants. Non-virulent pneumococci, which as a rule con-

tain little or no autolytic ferment, heated virulent pneumococci and pneumococci killed with formaldehyd solution or bichlorid of mercury fail to yield any toxic substance for normal guinea-pigs. The toxic property of extracts of virulent pneumococci is destroyed largely on heating to 60° C. for half an hour and wholly on boiling for ten minutes. Digestion with serum, with leukocytes or with trypsin at 37° C. for eighteen to ninety-six hours also destroys the toxic power. A similar toxic substance is obtained at a certain period in broth, and especially in serum broth, from cultures of virulent pneumococci. Here especially and less so in the NaCl solution extracts, the toxicity is greatest when proteolysis as determined by the formalin titration method has reached a definite point.

The author concludes first, that pneumococci, and hence probably other bacteria furnish at least a part of the anaphylotoxic substance when treated with amboceptor and complement *in vitro*, as well as *in vivo* when injected into previously sensitized animals, and secondly, that the symptoms in pneumococcic infections may be due to this highly toxic substance. The finding of this toxic property of extracts of pneumococci has another important bearing. Based on studies of anaphylaxis a number of investigators conclude that bacterial intoxication is possible only after certain antibodies have been formed which now attack the infecting bacteria and convert their relatively harmless bacterial proteins into highly toxic products. That this may be the case in many infections is supported by clinical observations. But in view of Rosenow's results and other facts, it seems certain that at least some strains of virulent pneumococci possess all the essential properties to produce disease forthwith.

Production of Antibodies by Tissues Living Outside of the Organism. A. Carrel and R. Ingebrigtsen⁴ report experiments which indicate that tissues cultivated *in vitro* retain the property of reacting against antigen by producing antibodies. Guinea-pig bone-marrow and lymph-glands were cultivated in guinea-pig's plasma in Gabritschewski boxes. Goat's blood was selected as an

(4) Jour. Amer. Med. Assoc., Feb. 17, 1912.

antigen because it is only slightly, or not at all, hemolyzed by guinea-pig's serum. Two drops of washed goat's blood-corpuscles were generally added to a culture containing twenty drops of plasma and five or six drops of a suspension of tissues in Ringer's solution. Together with every culture containing goat's red blood-corpuscles, a control culture without antigen was prepared. Other control cultures were made, composed only of pig's plasma, goat's blood and bone-marrow killed by heat.

The Gabritschewski boxes were then deposited in an incubator at a temperature of 39° C. After a few hours, the fragments of bone-marrow and lymph-gland were surrounded by cells which soon invaded the whole medium. On the second day of their cultivation *in vitro*, leukocytes were inactive against the red blood-corpuscles, but on the third day they phagocyted them rapidly. On the fourth or fifth day, the boxes were opened. The plasmatic jelly was cut in small pieces and aspirated into a large pipette. The fluid that covered the bottom of the box was also taken. Fluid and medium containing the tissues were placed in glass tubes, frozen, brought back to room temperature and centrifugated. The technique of Epstein and Ottenberg, which permits of testing the hemolytic power of very small amounts of serum, was followed. The characters of the hemolysins were investigated by the ordinary methods.


It was found that the serum of the cultures containing goat's blood had acquired the power to hemolyze markedly goat's red blood-corpuscles, while the serum of the control cultures remained inactive. It follows that hemolysin appeared in the cultures under the influence of the antigen.

Autoserotherapy in Infections. M. P. Modinos⁵ calls attention to the method of autoserotherapy in infectious diseases which he was the first to apply in a general way. The method consists in raising a blister on the skin, and when the bleb is well filled with serum withdrawing about 8 c.c. with a hypodermic syringe and injecting it under the skin. The location of the injection is not important. He now reports 16 cases in which he has

employed this method, in most cases with marked success. The cases treated include 4 of influenza, 4 of typhoid fever, and 8 cases of Malta fever. Occasionally one injection suffices to inaugurate a cure, but usually two are needed at 5 days' interval, and sometimes a third must be made. The author does not regard the method as a panacea, but he believes that the fluid of the blister contains a changed proportion of leukocytes and substances which, when injected under the skin, are capable of acting as antigens, provoking the formation of immune bodies.

New Conception of Immunity. A new conception of immunity is proposed by C. C. Bass,⁶ based on the necessary presence of two substances to secure the destruction of protoplasm, either protozoal or bacterial. The two substances are:—1. Amboceptor, which is generally specific but may sometimes be common. 2. Complement, which is common with reference to antigen but is more or less specific with reference to the source of amboceptor. This complement in man's serum is more active with specific amboceptors in man's serum than with specific amboceptors in the serum of other animals. Bacteriolysis or protozoölysis requires the development of complement, and this development does not occur at ordinary febrile temperatures; consequently these processes are prevented by the local or general temperature, regardless of the amount of amboceptor present. In the event that human complement has developed in a blood (which it does under favorable conditions within a few hours) it increases in amount for a time. Then it again disappears in from thirty to seventy-two hours according to various conditions.

The destruction of organisms by the favorable conjunction of amboceptor and complement explains the difficulty of cultivating various infectious agents like the plasmodium malarie, the typhoid bacillus, etc. This is probably the reason why it is difficult to cultivate the typhoid bacillus from the blood taken in the later stages of the disease when the conditions for bacteriolysis are so favorable. This may be obviated to some extent by employing special media like bile, which prevents the de-

(6) Jour. Amer. Med. Assoc., Nov. 4, 1911. 

velopment of complement. The same results can be obtained by placing the culture immediately at a temperature that will prevent the formation of complement and yet not high enough to destroy the organism. Applying the principles set forth above the author has been able to keep alive and cultivate without difficulty the three common forms of malarial plasmodia.

Applying this theory to therapeutic measures we have reversed conditions and we then desire to favor the formation and activity of complement. We may take as a favorable illustration an ordinary infected abscess. As a result of the bacterial toxin, inflammation ensues with its accompanying hyperemia and swelling due to exudation of serum and usually of leukocytes. The latter engulf the bacteria but are unable to destroy them for lack of complement, which cannot develop because of the local elevation of temperature.

Finally, sufficient necrosis occurs to give rise to a macroscopic cavity filled with pus. This may continue to increase in amount and the bacteria live and multiply in it. If such pus is withdrawn and some normal serum rich in complement is added it promptly becomes sterile, provided the matter is in sufficiently fine division so that the complement supplied and amboceptor already present in the pus can reach all the bacteria present. If the pus contains some serum that has recently exuded from the tissues and if it is placed at proper temperature, complement develops and can be demonstrated by an appropriate test. If on the other hand the pus has been in the cavity many days and at high temperature it will have passed the age at which it can develop complement under any condition. If such old pus is withdrawn and the cavity allowed to refill with new pus fresh from the living tissues, and provided the temperature is kept below the inactivating temperature for human complement, then large amounts of complement develop and the bacteria are destroyed by the combined action of amboceptor and complement.

It should be stated here that complement will develop at quite low temperatures, but that the activity of human amboceptor and complement is much reduced at a temperature of 23° C. (73° F.) or less. Thus the very

process it is desired to favor may be materially interfered with by too much cold.

We seem to have herein an explanation for the good derived from cold applications to inflammations, even to the effect of high and incidentally cool climates in tuberculosis of the lungs. The temperature of the diseased foci is lowered by the constant inhalation of cold air.

Pyocyaneus Immunity. N. Gildersleeve⁷ discusses the immunity against *Bacillus pyocyaneus* with the following conclusions:—

1. A marked increase in both the opsonic and agglutinative elements can be induced in the animal economy by the injection of vaccine as well as living organisms. Therefore, employment of vaccine in treatment of local pyocyaneus infections would appear rational.

2. However, there is also a toxin produced by the organism under consideration, the action of which manifestly cannot be counteracted by the use of the vaccine.

3. Should one decide to employ vaccine in treating these infections, such vaccine must be prepared from the organism concerned in the individual infection under treatment, and never from strains that have been cultivated on artificial media for a number of generations. These organisms soon lose their virulence under artificial cultivation and at the same time, at least to a great extent, their power of conferring immunity.

4. Bacteriolytic elements can not be demonstrated *in vitro* under either aërobic or anaërobic conditions.

5. The phenomena appearing in the peritoneal cavity of guinea-pigs and rabbits, following the injection of the organisms, are apparently essentially agglutinative and opsonic (phagocytic); but little evidence is presented to confirm the statement to the effect that there is an active bacteriolysis.

6. Old toxic filtrates or extracts from the cells produce little or no increase in the agglutinative and opsonic functions; but the toxic filtrates do produce a high degree of immunity against such filtrates.

(7) Jour. Amer. Med. Assoc., July 22, 1911.

TYPHOID FEVER.

The chief point of interest in connection with the advance of our knowledge of typhoid fever is the wide and successful application of vaccines to the prevention of the disease. This measure which was applied with partial success by Sir A. E. Wright to the British troops serving in India and South Africa has been thoroughly tried by the United States government and has met with general approval. Its adoption by the army should encourage its further use in protecting large bodies of persons in civic life, such as the inmates of public charitable institutions, the personnel of hospitals, and members of schools and colleges. It may also find application in the treatment of typhoid-carriers. The use of vaccine in the *treatment* of typhoid fever has some advocates, but this must still be regarded as in an experimental stage, and theoretic considerations indicate that vaccine treatment is not likely to be successful in an acute septicemic or constitutional disease like typhoid.

No marked advance has been made in our knowledge of the etiology of this disease. Infected water still continues to be the main source by which the virus is distributed, especially in the larger epidemics. In endemic and sporadic cases, other sources of infection such as milk, oysters, the agency of flies and other insects must be looked for. The duty of the physician to meet the dissemination of typhoid germs with adequate remedies at the source of supply is well presented by the article taken from the *Journal of the American Medical Association*⁸ subsequently quoted.

In summarizing recent advances in our knowledge of typhoid it is desirable to point out the chief directions in which contributions have been recently made. These are summed up by J. Milhit⁹ under three heads: In etiology, the rôle of the bacillus-carriers; this includes the importance of regarding the convalescent as dangerous for a long time after apparent recovery. In clinical course, the conception of the disease as an Eberthian septicemia, taking its rise from the gall-bladder. In thera-

(8) Apr. 6, 1912.

(9) Prog. Méd.

peutics, prophylaxis by antityphoid vaccination and serum therapy according to the method of Chantemesse.

ETIOLOGY.

Oysters. The probability of contamination of oysters is discussed by H. S. Capps.¹ From an examination of three samples the author found the colon bacillus present in every case. The presence of typhoid bacilli was not demonstrated, although many tests were made for this purpose. According to Capps, oysters taken from deep water, or from a considerable distance from an infected point on shore are reasonably safe, provided they are handled carefully and are fresh. On the other hand, those taken from shallow water near sewers or other infected points are probably contaminated and are unfit for human food, and their use should be prohibited by law.

Epidemic from Milk. E. B. Bigelow² reports a milk-borne epidemic in which the origin of the disease was traced to a milkman who obtained his supply from a milk-car and four dairies. As others obtained milk from the car and no cases of typhoid had arisen on their routes suspicion was directed to the dairies. No person living on any of the farms had been recently ill, except one woman who, it was definitely proved, did not have typhoid fever. In order to detect a possible carrier blood was obtained from all the persons living on the four farms, and of the twenty-five samples examined one gave a positive Widal reaction. Further investigation of the man from whom this sample was obtained showed that he was a typhoid-carrier and the probable source of the epidemic which involved 204 cases. The author's experience in this case leads him to place a high estimate on the Widal reaction as a means of tracing the origin of the disease in similar cases.

Typhoid in the Philippines. W. P. Chamberlin³ has made an exhaustive study of the laboratory and clinical findings relating to typhoid fever in the Philippine Islands. He considers its prevalence and distribution, the

(1) Miss. Med. Jour., June, 1911.

(2) Jour. Amer. Med. Assoc., Oct. 28, 1911.

(3) Military Surgeon, January, 1912.

laboratory investigations, the clinical aspects and reviews six recent epidemics. From these investigations Chamberlin draws the following conclusions:—

1. Typhoid is a widely scattered and common disease in the Philippines; its incidence in Manilla is above the average rate for the United States and is exceeded only by a few of the worst American cities; the average admission rate among American soldiers in the Philippines exceeds that for the troops serving in the United States; medical officers from many regions report its frequent occurrence among the Filipinos.

2. The statistics from the Filipino (Native) Scouts show a much lower typhoid rate than for white troops, possibly due to failure to diagnose atypical cases.

3. Widal reactions performed on the blood of 591 healthy Filipinos suggest a comparatively recent attack of typhoid in about 6 per cent. of adults, but do not indicate that the disease is prevalent in childhood.

4. Many epidemics have occurred among soldiers in the Philippines and three outbreaks among natives have been studied. Epidemics of great severity among the Filipinos are either rare or unnoticed.

5. The occurrence of the disease in the Philippine Islands is quite evenly distributed throughout the year. The incidence is least in the second quarter.

6. The appearance of the Widal reaction in typhoid fever in the Philippines is not as a rule delayed.

7. Paratyphoid organisms are occasionally isolated in the Philippines.

8. The leukocyte count in typhoid remains normal for whites and is slightly increased for natives. The differential count is normal for both races.

9. The mortality for white troops in the Philippine Islands during the last five years has been no higher than at home. It appears somewhat higher for Filipinos but this may be due to failure to diagnose all the mild cases.

10. More than a third of the cases of typhoid fever, whether among Americans or Filipinos, are entirely atypical and cannot be diagnosed without laboratory methods.

11. Over half of the cases occurring in the Philippine Islands can be diagnosed clinically and differ in no es-

sential particular from typhoid fever as seen at home. This is true for both American and Filipino cases.

12. Much work still needs to be done among the natives to estimate the actual amount of mild and atypical typhoid which is occurring and to determine why extensive and destructive epidemics are not more often seen.

SYMPTOMATOLOGY.

Symptomatology of Typhoid Fever in Young Children. Typhoid fever in young children is comparatively rare, and when it does occur often presents peculiar features differing essentially from the course of the disease in adults. Holt states that he has never seen the disease in a child under two years old, and that it does not occur frequently until after the fifth year. Morse in his report of 3,680 cases of typhoid fever from the records of the Boston City Hospital, found only 284 cases or 7.7 per cent. in children under fifteen years, and only 3 cases in children under five years. In this series there were no cases under two years. The disease in young subjects often presents such unusual features in onset, course, and individual symptoms, as compared with the adult type, that the difficulties in early diagnosis are very great. For these reasons the following case reported by F. J. Barrett ⁴ is of interest.

The patient, a boy $3\frac{1}{2}$ years old, gave no history of previous illness. The pulse was rapid, 132, small and weak. There was slight cyanosis of the fingers and ears. The skin was dry and showed no eruption. The tongue was dry and heavily coated; the lips parched. The throat was normal except for slight hypertrophy of the tonsils. The superficial lymph-nodes in the cervical region, axilla, and groin were palpable. The liver and spleen were not palpable. The anal region was smeared with blood. The knee-jerks were active. The Kernig and Babinski signs were not present. There was no nystagmus. There was a marked internal strabismus of the left eye, but this had been present from birth. Pupils were equal and reacted normally. During the day of admission the patient became actively delirious. At 10

(4) Med. Record, Dec. 16, 1911,

p. m. the patient passed by rectum about 1,000 c.c. of bright blood. The delirium was very active and the child had to be restrained. He waved his arms about widely and called constantly for his parents.

There was a remittent temperature during the second week, no roseola but marked nervous symptoms. The blood was not tested for the Widal reaction until the 14th day when it was positive. The von Pirquet test was negative.

A feature of the convalescence in this patient was aphasia coming on toward the end of the febrile movement and lasting about three weeks. The child's mother says that he was always quite talkative and he became more so before he left the hospital, but during the period mentioned he was not heard to speak. There were no other nervous symptoms at this time and no paralyses were discoverable. The intelligence was apparently maintained during this time. Morse believes this phenomenon is probably due to a local anemia or edema. In other respects the convalescence was normal. The child rapidly recovered its strength, flesh, and color, and left the hospital on April 28 in excellent condition.

In the opinion of C. Achard and C. Flandrin⁵ the reason typhoid fever is considered rare in infants is because no one thinks of applying sero-diagnostic measures to babes in arms. And yet if this were done many a puzzling febrile affection in infants would be cleared up and the source of epidemics better traced. The typhoid syndrome in an infant simulates an ordinary gastrointestinal trouble or meningitis or pneumonia. They report a case, the third in their experience. There was no history of typhoid fever in the environment, but two sisters had died recently of supposed measles. The infant was 11 months old, breast-fed, and it recovered after a course of the typhoid fever of only thirteen days. The symptoms had been general depression and fever, diarrhea one day and then constipation, with vomiting. The lack of symptoms on the part of the lungs, intestines and meninges led to the suspicion of typhoid fever by exclusion. When the infant left the hospital its dejecta still contained typhoid bacilli. The treatment had been

(5) *Ann. de Méd. et de Chir. Infant.*, Sept. 1, 1911, Google

merely fifteen-minute tepid baths at 30° C. (86° F.) and regulation of the diet.

Urinary Excretion. Labbé and Bith⁶ studied the excretion of urine in typhoid fever in nine patients, by exact measurement of the amount of water ingested and the amount of urine eliminated, and the determination from these factors of the percentage or coefficient of diuresis. Their results show in general:—1. A diminution of the secretion during the height of the fever. 2. A slow and progressive increase during defervescence. 3. A urinary crisis at the beginning of convalescence. 4. A return of the secretion to normal at the end of about a month. 5. The occurrence of a relapse hinders the urinary secretion, although incompletely. This cyclic evolution of diuresis is found in practically all the cases, but in some of them its development is not so well marked. This may be due to various causes:—1. To the persistence of diarrhea during convalescence which masks the crisis of increased urinary secretion. 2. An essential absence of the crisis. 3. A simple delay of the crisis which does not occur at the beginning of apyrexia but only after some days. Their observations indicate that the diminished secretion during the fastigium is not due to the lack of drink. Most of the patients drank freely and, moreover, urinated quite abundantly. Among all those who had no diarrhea the amount of urine passed was more than one liter. The principal cause of the diminished secretion is the diarrhea but it is not the only cause, since most of the patients were constipated during almost the whole period of typhoid fever. The diminution of urine is certainly influenced by the perspiration when it exists, but this cause is of only secondary importance, for as a general rule there is no sweating during the height of the fever and this symptom occurs only at the critical point.

Lang has determined, moreover, that the evaporation of water from the surface of the body is not increased in febrile patients. On the other hand the diuresis may be influenced by a supplementary excretion of water from the surface of the lungs. Lang has shown that the re-

(6) Sem. Méd., Feb. 10, 1912.

spiratory exhalation of water is increased 50 per cent. in patients with fever.

The increase of urinary secretion at the critical period is not due to an increased amount of drinking. While some patients drank more than usual at this period there were others who continued to drink at the same rate and one took less water during the convalescence than during the fever, which, however, did not hinder his coefficient of diuresis from rising very markedly. The increase in urinary secretion during convalescence is not attributable to a diminution of evaporation from the skin, since it is at this period that the sweats generally appear. The cessation of diarrhea at this time is a cause for increase in urinary secretion but this is effective only in a certain number of cases. Inasmuch as none of the conditions which have been mentioned exert sufficient influence to explain the diminution of secretion during the fastigium and its increase during convalescence, these facts have been attributed to a retention of water accompanied by a retention of chlorids during the course of the fever with an increase in excretion of both factors during convalescence. The weight remains stationary or increases during the fastigium while the urine decreases. On the other hand during defervescence the weight falls while the quantity of urine rises. A similar retention of water and chlorin is found in all the other infectious diseases and is, therefore, a general phenomenon of fever which may be interpreted as depending on a necessity of the organism to provide for the defense against infection.

The relation between the body-weight and the urinary excretion is not so simple as has been assumed by Garnier and Sabareanu. In the observations of Labbé and Bith it was found that during the first part of convalescence there was in one case a diminution, in one case a stationary condition and in one case an increase of body-weight. During the second part of convalescence the body-weight increased rapidly. Thus the weight sometimes increases from the beginning of convalescence while the excretion of urine is also reaching its maximum. They find also that the cases of Garnier and Sabareanu do not illustrate this inverse relation of body-weight and urinary secretion so clearly as those authors suppose. These apparent ex-

ceptions are readily explained by the fact that there is loss of weight due to the nitrogenous tissues destroyed by the febrile process, the nitrogenous waste being excreted by the kidneys.

Relapse and Complications. A. A. Eshner⁷ reports a case of typhoid fever complicated by nephritis, intestinal hemorrhage, parotitis, neuritis, and hyperpyrexia in which the typhoid bacilli persisted in the blood to the twelfth week of the disease. The patient was a woman, 30 years old, who when seen August 26 had been feeling badly for three weeks and had been in bed for two weeks. She gave a history of having been seized with chilliness, followed by headache, abdominal pain, pain in the chest and elsewhere, with slight nose-bleed. The appetite was poor, the tongue coated, though red at the tip, the bowels loose, the stools watery, yellowish, offensive. There was slight cough with scanty, not rusty, expectoration. The temperature range had been for a week between 101° F. and 104.5° F., the pulse 84. A few rose-spots were distinguishable on the abdomen, but the spleen was not palpable. The heart and lungs presented no physical abnormality.

When the patient was admitted to the hospital the temperature was 102.6° F., the pulse 104, the respiration 32. The urine had a specific gravity of 1018 and it contained albumin and granular tube-casts, but no sugar. A blood-serum test made two days later yielded a negative agglutination reaction with typhoid bacilli. The bowels continued loose, and four days after admission a small hemorrhage from the bowel was noted, with an accompanying moderate decline in temperature. On the following day also two stools contained small amounts of dark blood. Likewise on September 2, old blood-clots were detected in two stools. On this day the patient appeared somewhat irrational and she complained of hearing badly.

On the next day the right parotid gland was found painful and swollen, and the temperature had risen slightly. By September 5 the temperature had fallen to 99° F., and on the 6th a positive agglutination reaction was obtained. On the latter date the left parotid gland also was

painful and swollen, though in lesser degree than its fellow. During the following week the temperature fluctuated between 99° F. and 102.4° F., reaching normal on September 14. Examination of the urine on September 7 disclosed again the presence of albumin and granular tube-casts. On the 9th the urine still contained albumin, but the temperature continued at the normal level until September 18, when it began to rise again, reaching 102.6° F. on the following day. From this time on it pursued an irregularly febrile course till October 29, when it reached and finally remained at the normal level. During this period it rose to 105° F. on October 9; to 106.2° F. (with a chill) on October 18; to 106.6° F. (with a chill) on October 22. On September 19 the swelling of the right parotid gland increased greatly, as did also the tenderness, the tumefaction extending as far as the tissues about the right eye. The gland felt hard and the overlying skin was discolored. The presence of pus being suspected an incision was made, but no discharge followed. Attempts at culture from the parotid gland yielded negative results. The urine still contained a trace of albumin but no casts.

On September 24 the patient complained of pain over the gall-bladder and in the lower extremities. A positive agglutination reaction was obtained with the blood-serum on September 26, and the leukocytes numbered 8,500. On October 5 there was complaint of severe pain in both lower extremities, particularly in the right popliteal space. The urine was now free from both albumin and casts, although a trace of albumin was detected again on October 15 and October 26. Some edema about the left ankle was noted on October 15, but this was attributed by the patient to an accidental injury. Pain and tenderness persisted in the left popliteal space, the former being increased by extension of the leg. On October 15 the number of leukocytes was 9,000, on the 19th 8,300. Malarial plasmodia could not be detected in the circulating blood. A cutaneous tuberculin test also yielded negative results. A blood-culture on October 29 yielded a pure growth of typhoid bacilli. The patient was dismissed, well, on November 11, after an illness lasting thirteen weeks.

Peritoneal Effusion. A. McPhedran⁸ calls attention to peritoneal effusion (ascites) in typhoid fever, and to the physical signs of exudate in the peritoneal cavity. Ascites occurs without any leakage of intestinal contents, and the fluid in two cases operated on was a clear serous fluid. The cause of the exudate is somewhat uncertain. However, its occurrence should not be matter for surprise seeing that the deeper ulcers must cause congestion, which means some degree of inflammatory exudate in the peritoneum covering their bases. Even this slight degree of inflammation must cause some serous effusion. Free exudate occurs in other conditions in which less irritation to the peritoneum is probable, *e. g.*, in serous cysts, as of the parovarium. It is highly probable that unsuspected serous exudates occur in a great variety of conditions. Recently it has been found that there is considerable exudate in healthy rabbits with young, there having been no other cause found to account for the exudate. It is probable that some peritoneal effusion is of frequent occurrence in pregnant women. Quincke long ago drew attention to the occurrence of such effusion in young *anemic* women with the first menstrual periods.

The *existence of peritoneal effusion*, when copious, is usually so easily determined, that little thought has been given to its demonstration. It is not surprising therefore that small effusions should be so frequently overlooked. Fluctuation furnishes the chief evidence of the presence of peritoneal effusion. The term fluctuation is, however, used so indefinitely that it has come to be applied to a variety of conditions. Originally it was applied to the wave-like impulse felt by the hand held in contact with one side of a sac filled with fluid, while it was tapped on the other. Now it is often applied to the sensation to touch produced by pressure on any part that yields easily and is readily displaced by moderate pressure, especially if suddenly applied, as, *e. g.*, fluid in a cavity, soft tumors, abdominal contents, subcutaneous fat, and even thick relaxed muscle.

It is obvious that percussion affords valuable information, but if we are to obtain the greatest assistance

(8) Cleveland Med. Jour., June, 1911. Digitized by Google

from it we must "knock" lightly. With a moderate degree of effusion, if the abdominal wall is thin, it is very easy to perceive the ripple-like fluctuation if the hand is not placed too near the spine where the wall formed by the quadratus lumborum muscle is thick and tense. It is easy to obtain the flat note on light percussion, and the tympanitic one with heavier percussion, or with the light percussion if the pleximeter finger be pressed slightly into the abdomen. The thicker the abdominal wall, whether from fat, muscle or edema, and especially if there is much loose subcutaneous tissue from which fat has been absorbed, the more difficult it is to determine the existence of fluid by any means at our disposal. That these means of examination will, under favorable conditions, enable us to demonstrate a small quantity of fluid the author has proved by many years' experience. The method of examining advised by all the textbooks to obtain fluctuation by tapping on one side of the abdomen with one hand while the other rests on the opposite side, is futile, except in cases in which the quantity of effusion is so great as to distend the abdominal wall beyond the reach of the intestines; then the "ripple" wave can be obtained from flank to flank; but this is a condition so obvious as scarcely to need demonstration.

Cholecystitis. J. McMillan⁹ reports the case of a married woman, aged 23, who reported that she had kissed a brother who had been removed to the hospital for fever. The author found her suffering from severe frontal headache, high temperature and furred tongue and two days later her blood gave a positive Widal reaction. The fever ran an ordinary course, the temperature becoming normal at the end of the third week. This was followed by labor which occasioned a slight rise of temperature. About the end of the eighth week she had an attack of pain on the right side of the abdomen, attended with the vomiting of about a pint of thick, yellow fluid. Symptoms of cholecystitis were observed and the patient was submitted to operation with the discovery of two gall-stones about the size of peas. When the tube was removed six rounded, rough con-

cretions were found, which were very friable, two being broken in removal. The author summarizes the important points as follows:

1. The presence of almost continuous constipation throughout the whole course of an ordinary illness from typhoid fever.

2. The development of inflammation of the gall-bladder during convalescence at about the eighth week of illness.

3. The development of peritonitis in connection therewith forming adhesions between the gall-bladder and the colon.

4. The presence of *Bacillus typhosus* in pure culture.

5. The presence of a few gall-stones consisting of cholesterin and mucin.

Hepatic Abscess. Celles¹ reports a case of abscess of the liver occurring without producing any symptom which attracted attention to that organ. The pus contained bacilli having the characters of the bacillus of Eberth. The authors find that such abscesses have been reported in 0.4 per cent. of cases. They have been able to find 19 cases in 5,495 cases of typhoid fever. They conclude that while a suppurative hepatitis in typhoid is a rare complication it is one of very serious prognosis, as only 2 cases of recovery have been observed.

Intestinal Hemorrhage. H. Whitehead² reports the results of an investigation of 14 cases of intestinal hemorrhage in typhoid fever to determine the effect on the agglutinating power of the blood. The method adopted was as follows:—As a rule a sample of blood was taken from the patient's finger soon after admission, in a small sterile glass tube, which was immediately sealed. The microscopic method was used, as it proved to be a convenient and reliable one. The serum was separated from the blood by centrifugalization, and measured out on a clean slide by means of a small sterilized platinum loop (Delépine's method) according to the proportion required. A 15-hour-old broth culture was used for each observation, and quantities measured in loopfuls as before. The dilutions were made with ordinary sterile

(1) Jour. de Méd. de Bordeaux, May 28, 1911.

(2) Lancet, Oct. 14, 1911.

CHART 1.

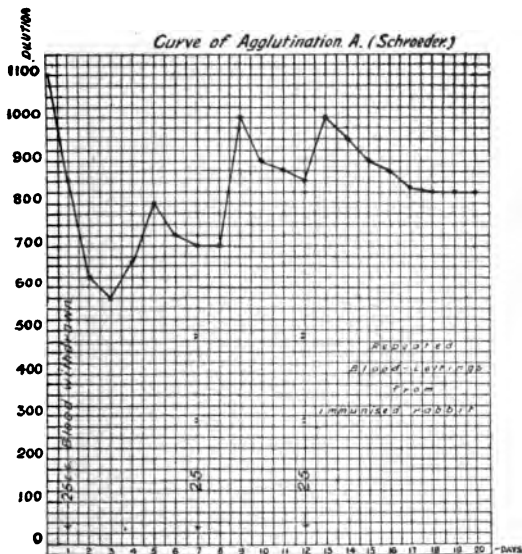


CHART 2.

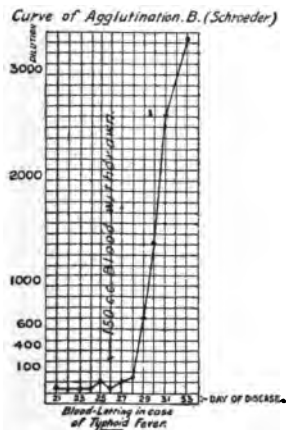


Fig. 1.

CHART 3.

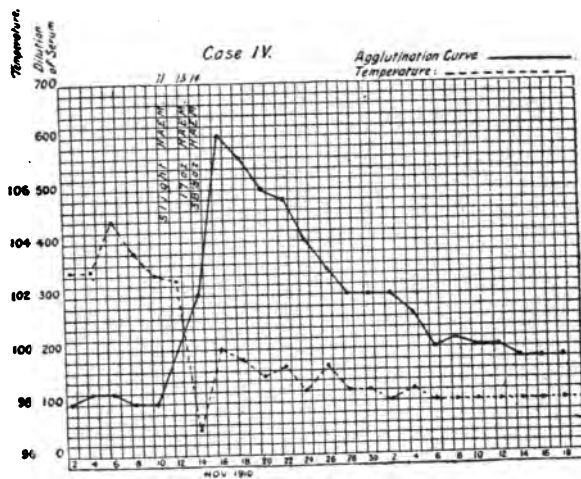


CHART 4.

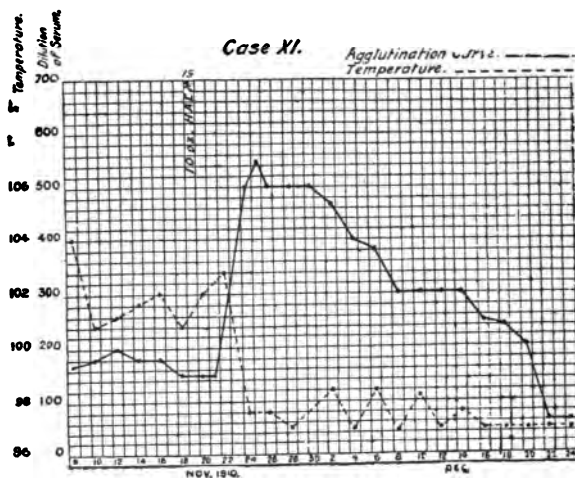


Fig. 2.

peptonized broth, and the same means of measuring adopted. When the required dilution was obtained a loopful of the mixture of serum, culture and diluent was placed on a sterile cover-slip and examined under the microscope as a hanging drop preparation. Various dilutions were tried in each case until a point was reached at which *no clumping whatever* took place in half an hour. These points of the clumping with minimum dilution are the ones registered on the accompanying charts.

The cases investigated prove that intestinal hemorrhage gives rise to an increased formation of agglutinins in the blood lasting for a short time, which may help to tide the patient safely over a dangerous period. (See charts 1 and 2.) As a result of these investigations it is recommended that, in many toxic cases of typhoid fever, and more especially in those in which the blood gives a poor agglutination reaction, phlebotomy to the extent of about 10 oz. (according to the physical condition of the patient) be tried as a treatment. It would in all probability give excellent results in many cases, as it would be without the accompanying dangers of intestinal hemorrhage.

Rupture of the Spleen. This is a rare complication of typhoid, E. Melchior³ having been able to find only 13 authentic cases on record. Getting up early is dangerous on this account, if the spleen has undergone a rapid and considerable enlargement. Signs of intraperitoneal hemorrhage suggest spontaneous rupture, and the spleen should be at once exposed and removed.

Pneumo-Typhoid Fever. According to Ardin-Deleil, Raynaud and Max Coudray⁴ typhoid pneumonia, although better known since the serum reaction of Widal, is still rare. Griesinger, in his large practice, has reported only one case. Since that time a certain number of observations have been published. Certain epidemics seemed to contain more material of this kind than others. According to Parrot, typhoid fever with initial pneumonia ought not to be rare in infancy. Nevertheless we have to do with a rare affection. The authors re-

(3) Centralbl. f. d. Grenzgeb. d. Med. u. Chir., Dec. 21, 1911.

(4) Prog. Méd. June 17, 1911.

port a case, which they summarize as follows: The case is a typical one of typhoid pneumonia. The development took place in two stages:—first, in the form of pulmonary phlegmasia; secondly, in the form of a typhoid infection. In the first stage the pulmonary symptoms were prominent and disguised for the moment the typhoid fever, leading to the diagnosis of an uncomplicated pneumonia. In the second stage, on the contrary, the symptoms were reduced to almost nothing; at the beginning, at least, the striking feature was the prostration, the bad general condition of the patient, in a word the typhoid state.

These two stages were separated by a period of quiet resembling the postcritical period of pneumonia; then the rose-spots appeared, an aggravation of the general condition took place and the typhoid fever followed its normal course. Its development, however, was quite slow, so that the prognosis was reserved at the beginning. The temperature, arrhythmia and waking delirium, contrasted with the usual mildness of typhoid pneumonia.

Attention is called to the long persistence of the pulmonary symptoms, which might have led at one time to the diagnosis of a reawakened tuberculosis, and also to their final complete disappearance. This perfect *restitutio ad integrum* leads to the belief that the pathogenic agent causing the pulmonary lesions was, to all appearances, the bacillus of Eberth. This could not be shown, however, since the culture of the liquid removed from the lungs by puncture remained sterile. This should not, however, cause us to reject the bacillus of Eberth as the cause of these lesions. In fact the blood-culture showed no micro-organisms other than the bacillus of Eberth. It is, therefore, natural to attribute to it an almost certain part in the production of these lesions.

Clinically, pure typhoid pneumonia resembles pulmonary congestion, tends toward splenization, perhaps occasionally toward true hepatization (here exact anatomic findings are necessary, rather than the simple clinical facts which lack the accuracy of a direct examination). Associated pneumonias, by the presence of the pneumococcus, take on more easily than we would be led to be-

lieve, the characterizations of a true pneumonia with fresh hepatization, and ought to be designated more particularly by the name typhoid pneumonia or better enteric pneumonia, in order to avoid all confusion with typhoid pneumonias.

Bacterial Methods. W. Gaetgens,⁵ basing his conclusions on the bacteriologic investigations of 528 cases of typhoid fever, makes the following suggestions for a practical campaign against the disease. Since the removal of a sufficient amount of blood for culture experiments is only rarely possible for many reasons, the greatest diagnostic importance not only in the later stages of the disease but also in the early stages of abdominal typhoid must be attributed to the agglutination test. The culture from the blood is especially of importance when properly carried out, more particularly in the clinic, and especially in the first week of the disease. The culture from a blood-clot is less significant but should not be omitted in any case as it may occasionally confirm the diagnosis. In the same way the examination of the feces should not be neglected in any case, for while not of equal value it must be regarded as an effective supplementary process to the testing of the blood, and permits the discovery of the bacilli in about half the cases. The culture of typhoid bacilli from the secretion of the tonsils and the coating of the tongue is of no great importance as a diagnostic aid. The occasional occurrence of typhoid bacilli in the mouth, however, is of interest in an epidemiologic respect and requires a suitable disinfection of the secretion of the mouth and the expectoration.

Intradermic Test. F. A. Prendergast⁶ proposes the following test for the existence of typhoid fever:—A few drops of a suspension of dead typhoid bacilli of the strength of less than 5,000,000 per c.c. are injected with a fine hypodermic needle into the skin, care being taken always to raise as superficial a bleb as possible. In twenty-four hours the non-typhoid patient shows a well-marked area of redness around the point of injection. The typhoid patient shows absolutely no reaction.

(5) Berlin. klin. Wochenschr., Feb. 12, 1912.

(6) Med. Record, Dec. 30, 1911.

The reaction as a rule begins to appear in twelve hours, reaches its maximum in twenty-four hours, and disappears in forty-eight hours.

Russo's Typhoid Test. Russo's⁷ test for typhoid is performed as follows:—To 4 or 5 c.c. of the patient's urine add 4 drops of a 0.1 per cent. aqueous solution of methylene blue; mix well and examine against the light; a mint or emerald-green coloration is positive, whereas any bluish tinge renders the test negative. Russo reported the reaction as being unaffected by boiling or by the ingestion of such drugs as calomel, quinine, salol or caffeine, and also pointed out that the gradual resumption of the bluish tinge, as the patient advanced in the disease, was a valuable and favorable prognostic sign. During the past year Rolph and Nelson have been employing this test as a routine proceeding, on most of the cases entering the Toronto General Hospital, and vouch as to its efficacy as a diagnostic aid in typhoid if applied early enough in the disease. Of 15 patients examined, 13 gave a positive Russo; 8 of these gave a negative diazo reaction, and 7 a negative Widal. Two reacted negatively to all three tests. One of these patients furnished a positive blood-culture and had typical symptoms. The other was an unusual case.

There is one important fallibility of the reaction, which at first bothered the authors a great deal, until one of them discovered the cause, *viz.*, that urines containing bilirubin will give a reaction which differs so slightly from the typical green, that they cannot be used in employing the test. Bile should be tested for, and in the event of its presence, the urine should be discarded.

The earlier in the disease the more likely and the more typical the reaction. This is very important, as it differs, in this respect, from other laboratory tests, except blood-culture. The slightest tinge of blue must call for a negative interpretation, though experience will often enable one to distinguish the returning blue tint of a convalescent typhoid patient, from that of a normal or non-typhoid urine. The reason of the mint or emerald-green color is doubtful, but it is probably a reduction test, depending on the presence of unknown bodies

(7) Med. Record, Aug. 19, 1911.

in the urine. The authors did not find the gradually returning bluish tinge of much assistance in prognosis, as so many of the dangers of typhoid, are, as it were, accidental, and not directly dependent on the severity of the infection.

H. W. Lincoln⁸ reports a case of abortive typhoid fever in which the Russo reaction was positive. This test was made by simply adding to 4 or 5 c.c. of the patient's urine 2 or 3 drops of a $\frac{1}{2}$ per cent. alkaline solution of methylene blue, when, if typhoid be present, there appears a most beautiful emerald green color of the contents of the test-tube. The patient was a male, aged 27 years, married, who took sick with slight malaise and dull headache. The temperature at first rose to 103° F. but soon declined to 99° F. and did not again rise above that figure. From the first the Russo test was positive.

A diazo test was negative, and a Widal was incomplete. A culture from the urine showed numerous and active typhoid bacilli. Subsequently, a second diazo and also a second Widal were done, the report coming back that there were still present a few very much less active bacilli, and that the Widal was negative.

The points of interest in this case may be summarized as follows:—the sudden onset; the absolute absence of all symptoms except slight headache (frontal and occipital), after the first day; the absence of splenic enlargement, meteorism, abdominal tenderness and discomfort; constipation of the bowels throughout; the absence of roseola; nose-bleed, and prostration; the presence of a good appetite and clean tongue at all times; during the entire illness there was not a single gastrointestinal symptom. Without the positive Russo reaction to suggest further investigation, and the urine culture which rewarded such investigation, the case would perhaps have gone on to recovery without diagnosis. Up to the date of preparation of this report the patient had had no relapse.

[A fallacy of this test is that a green color results from the mixture of the blue of the reagent with the yellow

(8) Med. Record, Mar. 30, 1912.

of the urine, and with a proper concentration of the urine this color may almost exactly simulate the color produced by the urine from a patient suffering from typhoid fever. The color has been closely imitated by placing the test-tube containing methylene blue in a beaker containing urine without mixing the liquids. Grave doubts were therefore thrown on the specificity of the test when it was at first proposed, and it would appear that in the hands of some observers it has not seemed to be of as much value as indicated by the authors just referred to.—ED.]

A. L. Grover⁹ concludes that while the test may be demonstrated in the urine of a large proportion of typhoid cases, yet it may be demonstrated in such a large proportion of cases in the urine of normal individuals that it is not a test with any specific meaning or value as to the presence or absence of typhoid fever.

Percussion Ridge. A New Sign. C. B. Burke¹ calls attention to a sign which he elicits as follows:—The arm of the patient is bared to the shoulder. Arch your thumb and middle finger in the shape of a horseshoe and place them over the biceps muscle of the arm, so that the arch thus formed is completely filled; then firm pressure is made by the finger and thumb, and the hand is briskly raised (pressure being continued) so that the thumb and finger come together with a slight concussion. The result, if the reflex is present, is a fibrillary contraction of that portion of the biceps muscle traversed by the thumb and finger, producing an oval ridge without complete contraction of the biceps muscle. The ridge thus formed disappears slowly.

He regards the sign as characteristic of typhoid fever to the extent that if the reflex described is absent there is no typhoid fever present. The reflex becomes less marked at the beginning of convalescence and gradually disappears. The author thinks that it is probably due to an irritation of the peripheral nerves, caused by some toxic agent. He found it positive in a few cases of gonorrheal rheumatism, in 7 out of 17 cases of pulmonary tuberculosis, and in 3 cases of appendicitis, which also gave the Widal reaction.

(9) Boston Med. and Surg. Jour. May 9, 1912.

(1) N. Y. Med. Jour., Dec. 16, 1911.

[While Burke failed to find a description of this sign in the literature it is by no means a new discovery. It was in common use as far back as 1879, and probably was known previously. It is a diagnostic aid, but is not pathognomonic of typhoid fever.—S.]

[This local contraction of muscular fibers may be elicited in many normal individuals, especially in neurotic people.—B.]

Retrohepatic Dulness. Ch. Lesieur² calls attention to the existence of a sign which he believes to be of great value in the diagnosis and prognosis of typhoid fever. He describes it as follows:—In the course of ordinary classic typhoid fever, if one percusses superficially the right base of the thorax, there is almost always found a notable degree of dulness which is not discoverable at the left base, which is not usually to be explained by pleuro-pulmonary lesions and the demonstration of which seems to have real value as to diagnosis, prognosis and treatment. The sign appears to be present as early as the fourth day and in rare cases has been observed at the very beginning. It is less constant at the height of the fever and most frequently disappears with the approach of convalescence. The author has only occasionally seen it persist after the fall of the fever, especially in the cases which were about to undergo a relapse, which fact indicates its importance from a diagnostic and prognostic point of view. Certain other conditions producing abdominal tension may give rise to a similar symptom probably by pushing the liver from below upward, but as these are non-febrile conditions the author believes that in the differentiation of typhoid from similar fevers the sign is of considerable value.

In order to elicit this sign it is necessary to make immediate percussion in a superficial way as the dulness is only slight, and strong percussion will not bring it out. The percussion must be made at the base of the thorax posteriorly and even toward the axilla, not simply at the extreme base where it is not unusual to find a slight degree of dulness, since normally the liver rises to the tenth intercostal space near the vertebral column

(2) Lyon Méd., Feb. 11, 1912.

and to the seventh in the axillary line. The slight dulness of which the author speaks may rise as high as the middle of the scapula. Nothing similar is found on the left side. Sometimes in consequence of congestion of the left pleura or lung there is a greater diminution of resonance on the left than on the right. It is always necessary to determine by other methods such as palpation and auscultation that the dulness noted at the right base is not due to disease of the pleura or lungs.

As to its diagnostic value the author believes that this sign may give great aid in making an early diagnosis of typhoid fever although it is not absolutely pathognomonic.

In prognosis its diminution or disappearance allows one to predict the prompt occurrence of defervescence and convalescence. If it persists or reappears after the fall of the fever a relapse may be expected. From this fact a therapeutic indication may be drawn that so long as the sign persists caution should be exercised with reference to an increase in the diet, and it may be well to prescribe hexamethylenamin for the purpose of exerting an antiseptic influence on the biliary tract. The author believes this sign to be occasioned by enlargement of the liver.

[It is difficult to accept the statements of retrohepatic dulness as occurring in typhoid fever, or as due to an enlarged liver. What agency would enlarge the liver in the early stage and disappear at the height of the fever?—B.]

TREATMENT.

Prophylaxis. The prophylaxis of typhoid fever so far as it can be carried out by the physician in private practice, is described as follows by the *Journal of the American Medical Association* ³. The protection of the community against typhoid infection is a part of the sanitary functions of the public health authorities. But since the infection in every case starts from an individual case of typhoid fever from which it may be spread in various ways, the primary responsibility for the spread of the disease rests in great measure upon

the physician in charge of the case. It is incumbent on him to see that no avenue by which the bacilli can escape into the external world is left unguarded. All germs excreted by the patient should be at once thoroughly destroyed. For this purpose no half measures should be tolerated. Disinfectants (true germicides, not antiseptics) should be employed and in strength sufficient to destroy with certainty the germs in the material on which they act. The physician should not rely on articles the disinfectant power of which has not been satisfactorily demonstrated. There is no occasion to use patented or secret articles. Efficient germicides are cheap, non-proprietary, and thoroughly well known. They should be provided in sufficient quantity so that they will be used freely enough to accomplish their purpose. It should be thoroughly understood that in this disease the disinfection should be carried on day by day throughout the course of the disease. Disinfection after the termination of the disease is of minor importance. Disinfection of the air is also relatively unimportant. The germs are borne by the solid and liquid excretions and the hands, clothing and food soiled with them. Direct contagion, although possible, is rare.

From the standpoint of prophylaxis the question naturally narrows down to disinfection of the urine, stools, sputum and of objects which may accidentally be contaminated by these excretions.

To disinfect the urine, the best solutions are, phenol (carbolic acid) 1 to 20, in an amount equal to that of the urine, or bichlorid of mercury 1 to 1,000 in an amount one-fifteenth that of the fluid to be sterilized. These mixtures with the urine should stand at least two hours. In case there is demonstrable bacilluria hexamethylenamin may be given to cause disappearance of the bacilli from the urine, but under no circumstances should its administration permit the disinfection of the urine to be neglected.

To disinfect stools, phenol is the most useful. It is cheap, and efficient if used in strong solutions. The stool should be mixed with about twice its volume of 1-to-20 phenol solution and allowed to stand for several hours.

Inasmuch as the water used in bathing is liable to be soiled by urine or feces, it is advisable to extend the disinfection to this material also. The disinfection of the bath-water after use is best accomplished, according to E. Babucke,⁴ by the use of chlorid of lime; 250 gm. (one-half pound) of chlorid of lime will render the ordinary bath of 200 liters sterile in one-half hour. In cases in which sponging is practiced the amount of water used would be small and would require a correspondingly small amount of the disinfectant.

If there be any expectoration, the sputum should receive the same care as in tuberculosis. It is best to collect it in small cloths, which may be burned.

All the linen leaving the patient's bed or person should be soaked for two hours in 1-to-20 phenol solution and then sent to the laundry where it should be boiled. It is recommended to boil the dishes from which the patient has eaten before they are taken from the room. If this precaution is impracticable they should at least be treated in some other way, as by wrapping in paper so that they cannot convey infection. They should afterwards be boiled or washed separately from the other dishes.

It is also recommended that the nurse wear a rubber apron when bathing or otherwise handling a typhoid patient, and also wear rubber gloves or else wash the hands thoroughly in a 1 to 1,000 bichlorid solution after she has finished; or as recommended in the *Journal of the American Medical Association*⁵ she should wash thoroughly in soap and water, followed by 70 per cent. alcohol. While it may be impracticable sometimes to carry out these precautions in their entirety, they should be regarded as the ideal to which the intelligent nurse or attendant will approach as closely as possible.

Great care should be taken to prevent access of flies to typhoid excreta and to food supplies. The room of the typhoid patient should be kept thoroughly screened in fly season. The nurse or other attendants should be taught to regard every specimen of urine as a pure culture of typhoid bacilli and should carefully avoid the spilling or scattering of drops of urine.

(4) Centralbl. f. Bakteriöl., 1900, Vol. XXVII, p. 800.

(5) Mar. 16, 1912.

The danger from contamination with the urine should be impressed on the convalescent patient, who should be encouraged to continue the use of hexamethylenamin and to report to the physician for examination of the excreta until it is satisfactorily shown that no more typhoid bacilli are being passed by the patient, either in the urine or feces.

The Typhoid-Carrier. In view of the frequency of typhoid-carriers, the difficulty of cure and the great danger they are to the public health, Meakins⁶ urges that every means should be employed for their recognition, prevention and isolation. The task of recognition of transitory carriers falls to the general hospitals, where over 50 per cent. of the cases of typhoid are treated. Every case, before discharge, should be examined thoroughly bacteriologically, and should be kept in the hospital or under strict observation and be treated by homologous vaccines until the excreta are free of typhoid bacilli beyond peradventure. If they could be re-examined six to twelve months afterwards, especially the adult women patients, much would be gained. Search should be made for the source of infection in every case of typhoid, and the district physician should be informed when a known carrier is in his jurisdiction, so that he can keep him under supervision. Those patients who are not treated in hospitals should be strictly watched and frequently examined by a special department of the board of health.

Germany has dealt with this question in a masterful way. In the southwestern part of the empire typhoid fever is largely endemic. On the recommendation of Koch, stations were established in this district under the municipal government. Each laboratory was well supplied with skilled bacteriologists, who worked in conjunction with the local authorities. Their duties were fourfold—to diagnose typhoid, to ascertain the source of infection in each case and to examine for infected persons, to supervise and regulate the general hygiene of the district, and to make bacteriologic examinations of stools and urine, in order to determine when convalescents cease eliminating typhoid bacilli. By their

(6) Canadian Med. Assoc. Jour., August, 1911.

work they have made great strides in the prevention of typhoid, more especially as regards the typhoid-carrier. As there is no other source for malarial infection than mankind, so it is with typhoid, which practically means that if we can prevent, cure or render innocuous the typhoid-carrier, we can get rid of typhoid fever.

Antityphoid Vaccination. R. W. Wilcox⁷ describes as follows the preparation of material for antityphoid vaccination:—The Eberth-Gaffky bacilli are grown on agar for twenty-four hours and the growth washed off with normal salt solution. The bacilli are killed by heat at from 55° to 56° C. (131° to 132.8° F.) on a water-bath. The solution is standardized by counting the bacilli by Wright's method, diluted with salt solution and one-fourth of one per cent. of tricresol is added. Each cubic centimeter contains 1,000,000,000 bacilli. The solution is delivered in hermetically sealed glass ampoules.

The procedure of administration is as follows:—The initial dose is 500,000,000, and two successive doses of 1,000,000,000 are given at ten-day intervals. The antibodies develop in from five to ten days later, and are bacteriolysins, opsonins and agglutinins, the last in large amounts. The last two measure the antibodies present, since their quantitative relations are quite constant. The increase in agglutinins is quite evident in four to five days; the fall begins in six weeks and the normal is reached in fifteen months. The injection is given in the deltoid region, the skin being previously washed with tricresol solution and soap. The needle puncture is closed with the compound solution of tricresol (cresol, 500; linseed oil, 350; potassium hydroxid, 80; water to 1,000). Tincture of iodine may be substituted for the latter purpose, but the compound cresol solution for use in camps is the ideal method.

The following results are reported:—The Second Division, Seventh Army Corps, at Jacksonville, Fla., in 1898: Mean strength, 10,759; cases of typhoid fever, 1,729; deaths from typhoid fever, 248. The Maneuver Division at San Antonio, Tex., in 1911: Mean strength, 12,801; cases of typhoid fever, 1; deaths from typhoid fever, 0.

(7) Amer. Pract., March, 1912.

The results of antityphoid vaccination are so striking, and the enormous saving to the army of its fighting strength by its use are so great, that the work of the Medical Corps of the United States Army in 1911 may be truly said to mark a new epoch in preventive military medicine.

C. C. Bass⁸ reports the results of antityphoid vaccination in 247 cases. Of these, one has had typhoid, and, in fact, had it when he was vaccinated. He had been complaining of headache and malaise for several days, but had not taken his temperature when he was vaccinated. He had a moderately severe reaction, but, after two days, came back to the laboratory to work, when his temperature was taken and found to be 101.5° F. He went to bed and had a mild typhoid fever, lasting eighteen days. Typhoid bacilli were grown from the blood. The short duration of the fever after it was recognized, and the previous history, indicate that he had typhoid fever at least three or four days before he was vaccinated. This case indicates that the vaccine may not be very harmful if unintentionally given during an attack. Over two-thirds of the 247 vaccinated have been seen or heard from, and are known not to have had typhoid; and most of them still give strong agglutination reactions.

In conclusion Bass emphasizes the fact that, though typhoid vaccines are variable, and though there is considerable experimental work necessary before the most can be accomplished, the evidence of immunity is so strong and the amount of inconvenience and discomfort is so small that physicians, nurses and others frequently exposed to typhoid infection should take advantage of vaccination. The agglutination test should be used, both to determine when immunity has been secured, and, therefore, as a guide, and also as a check on vaccines with low immunizing powers. The quick macroscopic typhoid agglutination-test can be made in one or two minutes, and has many advantages over the usual microscopic test for this and other purposes.

Antityphoid Vaccination by the Intestinal Route.
J. Courmont and A. Rochaix,⁹ after considerable experi-

(8) New Orleans Med. and Surg. Jour., December, 1911.

(9) Lyon Méd., July 30, 1911.

mentation in the application of typhoid vaccine to the intestine, tried the method as a therapeutic measure in man. They sum up their results as follows:

1. Vaccination by the introduction of toxins into the intestine is possible.
2. It is easily accomplished with a culture of the bacillus of Eberth, killed at 53° C.
3. It can be obtained, but in an inconstant manner by administration by the mouth.
4. Introduction into the large intestine by enemata is preferable.
5. These injections are well borne and are not noticed.
6. After a negative phase (which is perhaps not constant) immunity is established. It may be shown in the goat, the rabbit or the guinea-pig by the inoculation of virulent cultures.
7. The immunity is also antitoxic.
8. Agglutinating, bactericidal, and bacteriolytic properties appear in the serum of the vaccinated.
9. Man bears very well without any clinical reaction, injections of 100 c.c. of the vaccine. The authors recommend three injections at intervals of 10 days. These enemata cause the development of the agglutinating, bacteriolytic and bactericidal properties of the serum, just as does the vaccine given by subcutaneous injection. Immunization is at least as probable as by the hypodermic route. The method of vaccination by enemata being absolutely inoffensive deserves a trial.

[Experience has shown the hypodermic method is successful; it is not painful and if done with surgical cleanliness is not dangerous. Why try other methods which may not successfully accomplish the desired immunity? —B.]

Reactions Induced by Antityphoid Vaccination. H. Albert and A. M. Mendenhall¹ conclude as follows their investigation of reactions induced by antityphoid vaccination:—

1. Statistics based on a large number of cases show conclusively that antityphoid vaccination confers a marked degree of protection against typhoid fever.

2. The injection of typhoid vaccines induces a local reaction in all cases and a general reaction in some cases.

3. A previous attack of typhoid fever apparently

(1) Amer. Jour. of Med. Sciences, February, 1912.

causes the reaction to be more severe than is observed in individuals who have not had typhoid fever.

4. Antityphoid vaccination causes a marked increase in the specific agglutinins, opsonins and bacteriolysins.

5. The injection of typhoid vaccines causes a marked polymorphonuclear neutrophilic and large mononuclear leukocytosis.

6. The marked increase (both absolute and relative) of the large mononuclear leukocytes in the peripheral blood is the only leukocytic change which is common to both clinical typhoid fever and antityphoid vaccination.

7. Such occurrences suggest that these leukocytes have something to do with the formation of antibodies concerned with the production of antityphoid immunity.

8. It seems well worth while to attempt experiments on the artificial production of large mononuclear leukocytosis, to determine what relations it may have to the production of antibodies in the presence of typhoid infection or antityphoid vaccination.

Medical Treatment. Some good general hints on the treatment of typhoid are given by C. P. Wertenbaker.² For an initial purge the author usually gives a dose of castor oil with some aromatic. He allows nothing in the way of food except orange juice which may be taken *ad libitum*. Usually a pint or more of the juice is consumed in twenty-four hours. The juice is squeezed from the oranges, strained, and given cold. Patients generally like it, and do not tire of it as they do of a milk diet. The patient is encouraged to drink water freely, and is given tea freshly made, when desired. Little or no medicine is given; an occasional dose of turpentine emulsion or of asafetida is given if tympanites is troublesome. Ten drops of dilute hydrochloric acid three times a day may be useful. Strychnine is used as a heart stimulant. The lower bowel is washed out by an enema once or twice daily. A sponge bath is given whenever the temperature reaches 103° F. but is seldom necessary. When the temperature has remained normal for twenty-four hours, the tongue clean, and the red edge at the tip has disappeared, Wertenbaker al-

lows the patient one soft boiled egg, with a cup of tea or coffee.

Ipecac. W. L. Frazier³ has used ipecac in 6 cases of typhoid with good results. The following case describes the method of administration. A woman, 44 years of age, was seen first on the third day after becoming confined to her bed; the case was diagnosed as typhoid on the sixth day of her illness, the Widal test being positive. At 8 p. m. of the sixth day she was given 15 minims of tincture of opium; thirty minutes later she was given 30 gr. of pulverized ipecac in salol-coated capsules; the room was made dark and she was required to lie on her right side for two hours, so that the capsules might pass out of the stomach as quickly as possible. In this way vomiting was prevented by getting the ipecac past the stomach without coming in contact with the stomach wall. On the seventh, eighth and ninth days ipecac was given in the same manner, the dose being decreased 5 gr. each day, on the ninth day the dose being 10 gr. On the tenth, eleventh and twelfth days the dose was 10 gr. each day. The highest temperature recorded was 103.8° F. on the seventh day. The highest recorded on the eighth day was 99.6° F. There was no elevation of temperature after the ninth day. The ninth day of her illness was the fourth day she was given ipecac. The remaining cases were treated similarly. Frazier says it is necessary that each fecal discharge be carefully examined to find whether or not any of the capsules pass without being dissolved.

[One wonders why medical literature is filled with such reports as this one. Certain it is that we have no specific *drug* cure for typhoid fever. Then why give ipecac or any other drug as a routine?—B.]

Hexamethylenamin. G. Malan⁴ has tried the administration of hexamethylenamin to 21 typhoid patients in doses of 1.5 gm. daily, but with inconclusive results as the period of the epidemic seemed to exercise more influence on the condition of the patients than the remedy used. He calls attention to the necessity of taking into consideration the period, whether the beginning, middle or end of an epidemic, in making compari-

(3) Med. Record, Nov. 4, 1911.

(4) Gazet. degli Osped. e delle Clin., Mar. 12, 1912.

sons of different remedies and forming an estimate of the curative power of a medicine.

Acetyl-Salicylic Acid. G. Chambers⁵ endorses the use of acetyl-salicylic acid (aspirin) in small doses, 3 to 5 grains every four hours, combined with tepid sponging, in typhoid fever, as an effective means of lowering the temperature. The exhibition of the drug in these doses to typhoid patients does not alter the blood-pressure or produce any appreciable ill effects. The skin remains moist, and in some cases there is profuse sweating. The greatest effect on the temperature is obtained by sponging the patient about half an hour after the administration of a dose of the drug, in this way combining the antipyretic actions of the medicinal and hydrotherapeutic agents. Chambers has been especially impressed with the marked diaphoretic and antipyretic actions of the drug. Three grains every four hours had frequently considerable effect and in most cases 5 grains at the same periods produced profuse diaphoresis.

In giving acetyl-salicylic acid to typhoid patients, it is desirable, therefore, to commence with a dosage of 3 gr. every four hours; if this should not be sufficient, the quantity should be gradually increased until the desired effect has been obtained. Chambers suggests as the reason why acetyl-salicylic acid is more effective as an antipyretic in typhoid fever than in most other fevers, that probably the fever of typhoid is frequently labile in character. This theory also affords an explanation of the undoubted value of hydrotherapy in the treatment of the disease, because it is found that the more readily the temperature can be reduced by a bath or sponge the better the prognosis.

Vaccine Treatment. J. Callison⁶ has used vaccine treatment in 27 cases of typhoid fever. He concludes as follows from his experience with it:—

1. The production of antibodies or protective substances in response to the inoculation of a vaccine follows definite fixed laws, regardless of whether the vaccine is given for prophylactic or curative purposes, and the results in treatment must be interpreted in the light of what is known of these laws.

(5) Brit. Med. Jour., Jan. 20, 1912.

(6) Med. Record, June 24, 1911,

2. Inoculations of vaccine in typhoid fever prevent relapses and lessen complications, and in some cases probably also shorten the original attack.

3. Stock vaccines should be given in preference to autogenous vaccines in typhoid fever. The older the culture the better.

4. When given in therapeutic doses such stock vaccines are without injurious effect, and do not interfere with other treatment.

5. The routine treatment should be continued until the fever process is controlled by the vaccines.

6. The dosage used by many of those who have treated typhoid with vaccines in the past has been too small to secure the best possible results.

7. Every case of typhoid fever should receive vaccine treatment as soon as a diagnosis is made, and this should be continued until the temperature becomes normal or it is demonstrated that the case will not respond to this form of therapy.

[I think clinicians who understand the principles of immunology will not use vaccines in the treatment of typhoid fever. The Editor abandoned it five years ago after a sufficient trial to prove its fallibility in treatment. The experience gained at that time impressed one with possible harmful effects. One patient developed an acute peritonitis. Laparotomy failed to show intestinal perforation, lymph-gland rupture or other traumatic cause. Typhoid germs in pure culture were obtained from the peritoneal fluid exudate. The patient recovered.—B.]

Serum Therapy. H. Forssman⁷ reports the results in 20 cases treated with the typhoid serum of Kraus, and while he recognizes the fact that this number of cases is too small to permit safe conclusions with reference to the action of the serum he thinks it cannot be denied that as a rule an improvement of the patient was observed after the use of the serum, so that of those cases which were treated early in the first week almost all showed a mildness in the course of the disease which otherwise occurred only as an exception in the epidemic. He, however, comments on the difficulty of treating a typhoid patient with

(7) Deutsche med. Wochenschr., Oct. 19, 1911, Google

serum so early as in the first week. This would be possible only in the case of an epidemic.

Rest. R. T. Styll⁸ emphasizes the importance of rest in the treatment of typhoid fever. The patient should be at once confined to bed, and relieved of every kind of mechanical effort by the nurse; the correct use of the bedpan is imperative. Physiologic rest of the bowels is a necessity. Routine purgation should be avoided. Constipation should be relieved by a mild aperient or an enema. Food should be of such kind and quantity as will leave the least residue of undigested substance in the bowel. The stools must be examined daily to ascertain whether they contain undigested matter.

Cleanliness is also of the utmost importance for the repair of the inflamed or ulcerated surfaces. Regular evacuations ought to be sufficient for this purpose, as in health. Intestinal antiseptics are useful in reducing the severity of the local symptoms and in improving the general condition.

Diet. *Coleman and Shaffer's Plan.* B. B. Crohn⁹ has followed the general diet recommended by Coleman and Shaffer in treating 30 patients ill with typhoid fever. This diet consists of a liberal portion of protein but with a very greatly increased carbohydrate ratio as well as a moderate increase in the fat content. The aim of these authors was to provide a diet which should convert a minus to a plus nitrogen balance, prevent loss of weight during the infection and maintain general nutrition; this to be done by so greatly increasing the carbohydrate and fat proportion of the food as to prevent nitrogen loss. The foods offered were easily digested and assimilated, leaving small residue and causing no undue gastrointestinal disturbances. Their patients were fed at short intervals throughout the day, and at longer intervals at night; the dietary consisted of liberal quantities of milk with cream or cocoa, cereals, eggs, broths, bread, butter and whisky. In addition they made use of an almost tasteless sugar, capable of administration in large quantities, namely, lactose. This sugar they used in quantities up to 10 to 20 ounces a day. Cream, on account of its high fat content and very high caloric value, was also

(8) Virginia Med. Semi-Monthly, Oct. 13, 1911.
(9) Jour. Amer. Med. Assoc., Jan. 27, 1912.

liberally used. The caloric value of the day's ration as administered by them usually varied between 3,500 and 5,000 units; an occasional patient may have taken 6,000 calories or even more for a short period. With such a highly nutritious forced diet, consisting for the most part of carbohydrate and fat, they reported satisfactory results. The diet was well received and untoward symptoms were not observed. Their studies in protein metabolism, undertaken throughout the course of the infection, show a very marked diminution in the customary nitrogen loss. This latter in many successful cases was completely checked or even converted into a nitrogen gain; the loss of weight was similarly seen to be greatly diminished or to have ceased.

Crohn believes from his experience that the diet is practical and well taken by the patient. He experienced no difficulty in giving a diet ranging in caloric value from 3,000 to 4,700 units during the active febrile period. The food was well borne, nausea and vomiting were exceptional, and abdominal distention and intestinal symptoms were practically unknown. The nutrition of the patient remained, in all but the most severe cases, unusually good. Most cases showed a slight loss in weight but this was compensated for by the gain during convalescence. The period of convalescence was shortened, and almost as soon as the fever ceased there was a rapid return of the strength and buoyancy of the patient.

The disease seemed to be better tolerated. In the series of 30 cases complications were rare and there were no deaths. While this series is too small to permit statistical conclusions, it is satisfactorily established that the severity of the symptoms was mollified, the nutrition and strength were better maintained and convalescence shortened.

J. L. Miller¹ has adopted a diet affording about 3,000 calories and modeled on that advocated by Coleman and Schaffer which he has now used for three years with great satisfaction. The patient should receive his food at frequent intervals rather than in three meals daily. Feeding at two-hour intervals has been found most satisfactory. From the above foods we can select a sufficient

(1) Ill. Med. Jour., September, 1911.

variety to tempt the appetite, provided the patient is not extremely ill. Knowing the amount of food necessary to be taken in the day the physician or nurse can approximate it. In case of diarrhea it may be necessary to reduce the cream. However, diarrhea occurs so infrequently in the course of typhoid fever that there is little to be feared on this score.

Diet Rich in Carbohydrates. E. R. Gardner² reports a case of typhoid fever the treatment of which was based on the principle that a diet rich in carbohydrates is best suited to make good the loss of nitrogen and to prevent toxin formation. The patient, a young man 18 years of age, was seen one week after his illness began; he had a temperature of 103° F., and he showed the clinical symptoms of typhoid fever. A Widal test proved positive. Treatment consisted in a carefully regulated diet, consisting largely of carbohydrates, account being taken of the caloric value of the foods used.

A milk mixture containing 7 ounces of milk, 1 ounce of cream, and 1 ounce of sugar of milk was administered every three hours during the entire course of the fever. With the above mixture the nurse was allowed according to the wishes of the patient to feed any of the following foods: One soft boiled egg; soft toast (without crusts) and butter; stale bread and butter; tomato or bean soup (strained, 8 ounces); beef lamb and chicken broth (8 ounces), thickened with powdered rice (*Q. S.*); oatmeal gruel (strained) containing the white of one egg (5 ounces); cocoa; cup custard; ice cream. Large amounts of cool water were given the patient daily, as was lemon albumin and lemonade, and in fact he was urged to consume large quantities of water.

The benefits which seemed to follow this form of treatment were briefly the absence of the typical typhoid facies, a good appetite, markedly less toxemia, nervousness and mental depression. There was no extreme emaciation; the stools were formed and well digested. There was a rapid return to normal health and good general condition.

Diet in Children Ill with Typhoid Fever. The dietetic treatment of typhoid fever in children presents a special

(2) Med. Record, Dec. 9, 1911,

problem. Gruels, cereals, eggs and milk foods not oftener than once a day form the staples of the diet recommended by C. G. Kerley.³ The following is a sample diet for a child five years old: 6 a. m.—Eight ounces of gruel with sugar or a small amount of broth added. Zwieback or dried bread and butter. 8 a. m.—A drink of weak tea with sugar or the whites of one or two eggs with sugar in orange juice. 10 a. m.—Farina, a wheat cereal, rice, served with butter and sugar, or maple syrup and butter. A drink of weak tea or kumys or matzoon, or perhaps a dried milk food. 2 p. m.—Eight ounces of kumys, matzoon, or skimmed milk diluted with gruel. Zwieback; dried bread and butter if wanted. 4 p. m.—Orange egg sherbet or a drink of lemonade or tea and sugar. 6 p. m.—Cereal or gruel with sugar and butter or with broth. If skimmed milk has not been given at 2 o'clock it may be given with gruel at this time. 10 p. m.—Gruel with sugar or broth or with wine. Fat in considerable quantity is poorly digested by young typhoid patients. It may be given, however, in small amounts when mixed with other foods. Foods containing protein should not be given in considerable amount until we know something of the course of the disease. Milk, scraped beef and soft boiled eggs are not well borne in young typhoid patients and a temporary reduction of protein is not felt by them. Drugs are of no service except to produce an evacuation when there are not two in twenty-four hours, and to control the evacuations when there are more than four in twenty-four hours.

Treatment of Intestinal Hemorrhage. R. Oppenheim⁴ prescribes the following course of treatment for intestinal hemorrhages:—

1. Omit baths and insure absolute rest. Ice to the abdomen.
2. Stop all medicine and food and give nothing but ice water and a little champagne. The next day iced milk may be given.
3. Give chlorid of calcium and opium: (Calcii chloridi, gm. 4 tr. opii., 5 c.c., aquæ ad 150 c.c. M. S. Take two teaspoonfuls once in 2 hours).
4. Opium in pill form may be given as needed.
5. If the hemorrhage is not arrested in a few hours give enemata of hot water with the addition of 4 gm. of cal-

(3) Amer. Jour. of Med. Sciences, March, 1912.

(4) Prog. Méd., July 15, 1911.

cium chlorid, the enema being given at low pressure. Give also enemata of gelatin. (Gelatin 50, calc. chlor. 8, aquæ ad 1,000.) 6. One may add injections of epinephrin. (Epineph. sol., (1-1,000) 1 c.c., with 250-500 of normal salt solution.) 7. When the hemorrhage has been abundant, give an infusion of physiologic salt solution. Solution of caffeine may be given: (Caffeine, sodium benzoate, $\bar{a}\bar{a}$ 0.5, sodii chlor., 3.50, aquæ 500, once or twice in 24 hours). Injection of ether or camphorated oil. 8. After the hemorrhage has been arrested give an enema of boiled water to evacuate the blood. Continue the liquid diet, maintain pressure by salt infusions and reduce the temperature by cold packs, etc. Return to the baths after 24 or 48 hours.

Transfusion for Hemorrhage. L. S. Booth ⁵ reports a case of typical and serious typhoid fever, resulting in two severe hemorrhages on the twenty-fourth day of the disease. Ordinary therapeutic measures including calcium lactate, hypodermoclysis and injections of rabbit and human serum were without any marked effect. Direct transfusion with a related blood was done with the patient *in extremis*, and a really remarkable effect on the vital signs of the patient resulted. The transfusion restored the ground lost by the patient from the acute depletion of the cardiovascular system, and from the lysis which was already inaugurated before the hemorrhage occurred. The author suggests that possibly especially good results might be obtained from the use of a donor who had previously been immunized to the disease.

MALTA FEVER.

Etiology. E. R. Gentry and P. L. Ferenbaugh ⁶ report an additional case with a description of their technic by which they isolated the *Micrococcus melitensis* from two patients. The organism was isolated by means of blood-cultures which were made in two ways: 1. The ordinary method of drawing blood with a syringe from a vein in the elbow. 2. By the sterile capillary-tube method of Zammit, the blood being taken from the ear. Both methods give good results. The

(5) Yale Med. Jour., January, 1912.

(6) Jour. Amer. Med. Assoc., Sept. 9, 1911.

Zammit method is especially useful in Malta fever since the organism is present in small quantities of blood during the febrile stage. Zammit isolated it from as small a quantity as 0.005 c.c.

Sterile broth in flasks was used as a preliminary enriching medium. The medium used for the isolation of the organism was a glucose-nutrose-litmus-agar containing 1 per cent. each of glucose and nutrose, and standardized to a reaction of plus 1. Two to four c.c. of blood were inoculated into the broth-enriching medium in the proportion of 1 part of blood to not less than 30 parts of broth. The broth cultures were then incubated at 37° C. for four days.

In a succeeding article Gentry and Ferenbaugh⁷ reach the following conclusions:

1. Malta fever is endemic throughout the older goat-raising sections of Texas.

2. Although typhoid fever is prevalent throughout these sections, we believe that careful serum tests will show that a large proportion of the cases diagnosed as atypical typhoid fever will be found to be suffering from infection with the *M. melitensis*.

3. All cases of Malta fever found have occurred in territory devoted to goat-raising and all patients either gave a history of drinking unboiled goat's milk, or were actively connected with the goat-raising industry.

4. While we have not yet found the *M. melitensis* in the milk of goats, the positive serum test obtained in 34 per cent. of goats examined points strongly to this animal as the source of infection.

P. L. Ferenbaugh⁸ also reports five cases of Malta fever, four being boy goat-herders and one a man aged 35, a goat ranchman. The diagnosis was established by the examination of blood, showing the absence of malaria, the agglutination test being negative for typhoid fever and positive for the *Micrococcus melitensis*.

Diagnosis. The Sero-Reaction. L. Negre has shown that the sera of many normal individuals and of healthy animals agglutinate the *Micrococcus melitensis*, and the same is true, according to the investigations of

(7) Jour. Amer. Med. Assoc., Sept. 23, 1911.

(8) Jour. Amer. Med. Assoc., Aug. 26, 1911.

L. Negre and M. Raymond,⁹ of the serum of patients suffering from various diseases. In all cases the serum heated to 56° C. for half an hour lost its agglutinating properties. This has never been shown to fail.

There exists, then, in a large number of individuals immune to Malta fever, a substance which causes agglutination of the *Micrococcus melitensis*. This substance is not specific, it is destroyed by heating ½ hour at 56° C., and thus is distinguished from agglutinins which are themselves specific substances, resisting a temperature of 56° C. These observations indicate the liability to mistakes in sero-reactions. The authors have not had occasion to examine the serum of Malta fever patients and therefore prove the above facts. In other words the authors have never encountered serum retaining its agglutinating power in the presence of *Micrococcus melitensis* after heating to 56° C.

However they have shown the following facts by experiment. Rabbits were prepared by intraperitoneal inoculation of cultures of *Micrococcus melitensis* on gelose and a specific agglutinating serum obtained. This serum, heated to 56° C., retained its agglutinating power, because it possesses a specific agglutinin which appears immediately after microbic inoculation and resists a temperature of 56° C. These determinations show clearly that only the sera of animals really infected by the *Micrococcus melitensis* possess the power to agglutinate the specific microbe after inactivation. They believe that the general character of the results justifies the application of the conclusions to man. In reality, there is only one irrefutable criterion for melitensic infection, that is the establishment in the blood of the specific agent of the *Micrococcus melitensis*. The technic of this test is too difficult for the general practitioner and therefore the sero-reaction has to be depended on.

The authors, therefore, basing their conclusion on the results of these researches, consider inactivation of the serum as an essential before practicing the sero-reaction of Wright, and they claim that only those cases should be accepted as really infected by *Micrococcus melitensis*

(9) Presse Méd., Aug. 23, 1911.

which continue to show an indisputable agglutination after heating to 56° C. for half an hour.

Euzière and Roger¹ call attention to the former confidence reposed in the sero-reaction of Wright in the diagnosis of Malta fever and to the fact that it has lost its reputation as a reliable test. The reason for this is that the reaction is very inconstant even in the same individual, and this when the technic has been the same.

The authors have made a considerable number of examinations, with this test and find that it gives good results. Upon changing the culture with which they had been operating, however, their result became quite discordant. In 21 sero-reactions made with the same technic as formerly 7 were positive in patients the most part of whom could not be suspected of having Malta fever. One was a case of infectious endocarditis, one a hypertrophic cirrhosis, three were cases of typhoid fever and of the two others one was surely Malta fever. As to the seventh the diagnosis is still in doubt. It appears therefore, that the test yields good or bad results according to the sample that one uses.

The sero-reaction of Wright should not be rejected, for it can furnish useful indications, but one should wait to learn the exact conditions under which it is infallible, and it is necessary to choose with care the culture which is to be used.

MALARIA.

Etiology of Relapses. The general character of malaria is well expressed by a summary made by E. A. Minchin.² Malaria in man or animals is a disease caused by a minute parasite which lives and multiplies in the blood, passing its trophic phase within the red blood-corpuscles. The parasite is propagated from one vertebrate host to another by the agency of certain mosquitoes, which, on sucking the blood of an infected vertebrate, takes various stages of the parasite into their stomachs with the blood; one stage of the parasite resists the action of the digestive juices of the mosquito and passes through a sexual process of generation and multiplication within the body of the mosquito, the cycle ending

(1) Gaz. des Hôp., Feb., 20, 1912.

(2) Jour. Amer. Med. Assoc., Dec. 2, 1911.

after some days with the production of many thousands of minute germs ("photospores," Ross) lodged in the salivary glands. If the mosquito then succeeds in biting a vertebrate of the right kind, that is to say, of the kind which is a specific host of the parasite in question, the germs pass down its proboscis and are inoculated into the blood, thus bringing about a fresh infection of the disease. Every statement made in the foregoing sentences is based on rigorous experiment or accurate microscopic investigation. It remains to add only that the various species of malarial parasites are specific to certain hosts, vertebrate or insect; those of birds, for instance, can be transmitted only by mosquitoes of the subfamily *Culicinae*; those of men only by the subfamily *Anophelinae*.

The question of the cause of relapses in malarial fever has aroused considerable discussion. Whether after a period of freedom from fever the recurrence is due to the activity of organisms which had remained latent in the spleen or some other organ, or whether a new development by parthenogenesis takes place, are theoretic questions which must await further experimental investigation. At the meeting of the Southern Medical Association G. E. Henson expressed the view that parthenogenesis cannot be considered a factor in the causation of recurrences, for this phenomenon has not been established. Many cases which at no time have shown the presence of sexual forms have frequently relapsed.

R. H. von Ezdorf, however, thinks from his observations that parthenogenesis may have something to do with the origin of recurrences. He has seen gametes in the blood and has found that under the continued administration of quinine the gametocytes disappeared while the macrogametocytes remained. He has found no evidence of a transformation of the gametes into the form which would revert to the schizodont cycle.

W. Krauss³ concludes a paper on the rôle of the gametes in relapsing malaria as follows: Practical experience in the field, while tending to show that gametes are very difficult to eradicate, proves that, with their removal, relapses do not recur. This might, of course, have a similar sterilizing effect on the encysted bodies of

(3) New Orleans Med. and Surg. Jour., December, 1911.

Craig. In any case, all the evidence tends to show that when there are no gametes there will be no relapses, although there may be reinfections.

To sum up, then, we have recurrences of malarial fever by means of reinfection from without, by reinfection from one's own gametes, by resegmentation of macrogametes (without the aid of anophelines and reintroduction), and possibly by conjugation or plastogamy, according to Craig.

In any case, it should be remembered that it is just the symptomless gamete-carriers who perpetuate the infection, and that every opportunity should be made use of to examine the blood of persons who have suffered from malarial attacks, and, if gametes are found, to use active and persistent cinchonization for at least thirty days. In Krauss' experience it has seemed more desirable, although not borne out by tropical workers, to interrupt this quinine therapy from time to time, and continue it somewhat longer. It is his opinion that a campaign directed against gametes is worth more in the eradication of malaria than all other methods combined. We will probably always have gametes; let us see that they remain sterile.

Pathology. *The Leukocytes.* The following account of the behavior of the white blood-cells in malarial fever is given by D. Thomson.⁴ During active malaria the number of leukocytes in the peripheral blood is decreased. During quiescent malaria, and in cases apparently cured by treatment, the leukocytes in the peripheral blood are much increased. During the rigor and temperature in malaria, the mononuclear leukocyte percentage (more especially that of the large mononucleated variety) is low. With the fall of temperature, however, the mononuclear percentage rises very high, sometimes even to 90 per cent. of the total leukocytes. This fluctuation in the percentage of total mononuclear leukocytes occurs also long after continuous quinine treatment, and is observed for months and even years (?) after the last attack of fever. In these apparently cured cases of malaria, the mononuclear percentage is lowest at the time of the day at which the rigor and fever occurred during the pre-

(4) Ann. of Trop. Med. and Parasitology, April, 1912.

vious active malaria; and, moreover, at this time there also occurs a very marked leukocytosis, which continues for only a few hours. The leukocytes often reach numbers as great as 30,000 to 50,000 per c.mm. of blood. On one occasion, noted by Thomson, they were as numerous as 125,000 per c.mm. Two hours later they had fallen to 22,000 per c.mm., and in eight more hours there were only 6,000 per c.mm. This case showed a regular daily periodic variation in the number of leukocytes, averaging from about 6,000 per c.mm. to 50,000 per c.mm. The height of the rise always occurred about noon. This was the time at which the rigor and fever, which was quotidian, was wont to occur previously. This post-malarial leukocyte phenomenon occurred always without exception in the 40 cases examined, and would therefore seem to be an infallible sign of previous malaria, as, so far, it has not been observed in any other disease. It would appear, says Thomson, that large numbers of malarial parasites, on sporulating, cause a leukopenia, while a very small number, on sporulating, cause a leukocytosis.

Symptomatology. Anemia. The cause of anemia occurring in some malarial affections is traced by M. Rowley-Lawson⁵ to the migration of the plasmodia from one corpuscle to another. He finds organisms free in the blood and also attached to or situated in corpuscles in every stage of degeneration. It is evident that the young plasmodium must have left the corpuscle at the expense of whose hemoglobin it has developed to continue its life cycle in a fresh corpuscle, affording a more abundant source of nourishment.

Estivo-Autumnal Malaria with an Unusual Anemia. Anemia following one or more attacks of malaria is exceedingly common. The anemia is of the secondary type, that is the decrease in the number of red cells is coexistent with a decrease in the hemoglobin content. Nucleated red cells are not found nor do the red cells show anisocytosis or poikilocytosis.

L. M. Warfield⁶ reports a case in which no parasites were found in the blood at first, but the blood-picture resembled that of pernicious anemia. A blood count was made which showed 1,520,000 red blood-corpuscles, 38

(5) Arch. Int. Med., Apr. 15, 1912.
(6) Interstate Med. Jour., August, 1911.

per cent. of hemoglobin (Sahli), 4,550 white blood-corpuscles, and a color index, 1+. The blood was very pale, watery, and thin, but did not have the appearance sometimes seen in pernicious anemia of a separation of plasma and red cells. A differential count showed 54.4 per cent. polymorphonuclears; 30.8 per cent. small mononuclears; 5.2 per cent. large mononuclears; 0.8 per cent. transitionals; 3.6 per cent. eosinophiles; 4.4 per cent. neutrophilic myelocytes; 0.8 per cent. eosinophilic myelocytes. In counting 250 cells one normoblast was seen. There were polychromatophilia and granular degeneration of the red cells, very slight poikilocytosis but much difference in size of the red cells. No parasites were seen. The von Pirquet test was negative. Examination of the stool showed no ova and no occult blood.

The blood-picture in this case was therefore most unusual. It is also rather remarkable that a count made on November 5th, at a time when the patient seemed, and apparently was, perfectly well should show a color index of 1+. It is possible that he was one of those individuals whose color index is normally 1 or 1+. The finding of myelocytes with nucleated red cells and an anemia with high color index plus general symptoms and signs was certainly sufficient basis for a provisional diagnosis of pernicious anemia. There are febrile cases of pernicious anemia in which the spleen is not infrequently enlarged.

Subsequently, three febrile paroxysms occurred and malarial tertian parasites were found. Quinine in 10-grain doses every four hours cut short the paroxysms.

Malaria in Children. According to the investigations of V. Fusco⁷ the blood of still-born infants of malarial mothers as well as that of those born living was free from malarial organisms. The disease was quite latent in children, no chills occurring and scarcely any symptoms being presented. In some cases the child seemed to be merely a carrier. His investigations were made in central Italy, and disclosed the fact that about 90 per cent. of the children at Grosseto harbored malarial parasites in their blood.

Pseudo-Relapses. By a study of 75 cases with regular

counting of the number of parasites R. Ross and D. Thomson⁸ were able to demonstrate the effect of quinine in ridding the blood of asexual parasites, and the absence of reappearance of the parasites while the drug was continued in moderate doses. Apparent relapses did, however, occur in which there was chilliness, rise of temperature, but without parasites in the blood. Similar rises of temperature are observed in other diseases and must be referred to some of the simple causes of fever. In some cases the temperature could be explained by an inflammation of the tonsils.

The same authors⁹ report a case in which there was a true relapse during the administration of quinine which was at first taken for a pseudo-relapse. As the rise of temperature persisted the blood was more carefully examined and the parasites were discovered. Examination of the urine showed that the quinine was efficiently absorbed.

Malaria with Cerebrospinal Fever. W. J. Collins¹ reports a case of coexistent epidemic cerebrospinal meningitis and malaria in a child of six years. The child was given Flexner's serum and large doses of quinine and responded quickly.

Diagnosis. From an examination of 15 cases for urinary pigment, compared with 20 normal cases in which similar pigment granules were found, F. B. Bowman² concludes that although pigment may be found in the urine in malaria, it would seem to require too much experience to distinguish the different kinds of pigment to make the examination of any practical value as a means of diagnosis.

Pseudo-Malarial Pyelitis. D. Vanderhoof³ calls attention to the frequency with which malaria is simulated by pyelitis. He reports 6 cases in which this similarity was noticeable and concludes his article with the following summary: Forty-seven patients with pyelitis have been seen during the past five years, of whom 21 had been treated for malaria. The clinical features of these two affections may be almost identical. The differentia-

(8) Ann. of Trop. Med. and Parasitology, December, 1911.

(9) Ibid., Feb. 26, 1912.

(1) Boston Med. and Surg. Jour., Oct. 19, 1911.

(2) Bull. of Manila Med. Soc., July, 1911.

(3) Jour. Amer. Med. Assoc., Apr. 20, 1912.

tion, however, is not difficult, but the confusion of the two conditions will continue until physicians realize that quinine is a specific in malaria, and that it is useless to continue this remedy if the febrile disturbance persists. Furthermore, quinine, even in moderate doses, is irritating to an infected kidney. The constitutional symptoms of a low-grade chronic infection of the genito-urinary tract simulate pulmonary tuberculosis, but in the absence of cough the condition is often regarded as a chronic malaria. The urinary findings in these cases may appear almost insignificant, but a urine that is apparently clear on gross inspection will show the presence of a few pus-cells, often accompanied by an occasional red blood-cell. Pyelitis is the cause of many unexplained fevers, and this is especially true in the case of young children.

[This is an unfortunate title. Like other septic processes pyelitis may be mistaken for malaria by the physician who does not thoroughly examine the patient day by day, if necessary.—B.]

Treatment, Illusions and Idiosyncrasies. H. L. Sutherland⁴ refers to some of the illusions with reference to malaria which are disadvantageous to a proper treatment. There is a widespread popular illusion that in the state generally termed "biliousness" with fever, the taking of quinine will cause hemoglobinuria and some doctors wait from day to day to get the desired effect of calomel on the liver while their patient's red cell-count is dropping a million or more per day. This hemolysis from quinine may occur in a negligible number of cases, but no heed should be given to it in estivo-autumnal fever where delay is dangerous. Even after the appearance of hemoglobinuria, if the parasites are found in the blood, quinine should be given by deep intramuscular injections.

Another illusion indulged in by the profession generally is that quinine to be effective should be given just before the chill. The author admits this to be the most opportune time, but on first seeing a case ten or twelve or even twenty-four hours after the chill he begins quinine without delay. Another very common delusion is the impression that almost every inhabitant has ma-

laria and that it prevails winter and summer. In consequence of this belief cases of incipient tuberculosis, disturbances of the digestive tract, septic fevers, etc., are treated for a longer or shorter time on the supposition that they are cases of malaria.

The author has found that patients with pronounced idiosyncrasies against quinine can bear it when it is given by intramuscular injection.

PELLAGRA.

Etiology. *The Sand-Fly.* The theory advanced by Sambon in 1910 that the sand-fly, *Simulium reptans*, is the conveyor of a supposed living virus of pellagra has aroused a considerable interest and stimulated investigators to a considerable amount of entomologic research to determine whether the habitat of such insects corresponds with the known areas of the disease in this country so as to make such an agency in the transmission probable.

The grounds on which Sambon founds his theory are stated by S. J. Hunter⁵ as follows:

1. The endemic centers of pellagra in Italy have remained the same since the disease was first described.

2. The season of the recurrence of pellagra coincides with the season of the appearance of the full-fledged sand-fly, even to the extent that if the spring is early or late, the sand-fly is early or late in appearing, and pellagra cases are correspondingly early or late in their appearance.

3. In centers of pellagra infection whole families are attacked at times simultaneously.

4. In non-pellagrous districts the disease never spreads to others with the advent of a pellagrin from a pellagrous district.

5. In the case of a family which has removed from a pellagrous to a non-pellagrous district, the children born in the former district are pellagrins, while the children born subsequent to removal to a non-pellagrous district do not develop the disease.

6. The disease is not hereditary, although infants a

few months old may become infected, especially if taken to the fields in pellagrous districts, where their mothers work during the season when sand-flies are in evidence.

7. Pellagra is not contagious, but is transmitted to each individual by an infected sand-fly.

His theory is protozoal and from analogy with the etiology of malaria, the parasite of pellagra in all probability would have to pass one stage in the body of its intermediate sand-fly host before it could resume its life in the human body. This hypothesis being true, transfusions obviously would be without result.

Simulium reptans is found in this country only in Greenland; hence if the sand-fly theory be true the disease must be transmitted in this country by some related species. *Simulium vittatum* is the only species of sand-fly found in Kansas and it is on this species that Hunter began his researches. The known pellagrins are in the midst of the sand-fly territory, thus giving a certain support to the Sambon theory. Sand-flies of the Kansas species were allowed to bite a pellagrin and then placed in a fly-proof cage with a male monkey. After some weeks the monkey began to be less active and refused food and became ill for a few days. He had a temperature of 103.6° F. which is a little above normal. He was killed by chloroform and placed in the hands of a pathologist, but the report of the necropsy is not given.

C. Thorington suggests that the mosquito may be the intermediate host for the transmission of the pellagra virus. He is led to this view by the analogies of the disease to malaria.

Sex Incidence. K. H. Beall⁶ has been struck with the preponderance of the female sex in the death reports from pellagra. There were in Texas, out of 189 cases, 153 females and 36 males. This he attributes to a cause existing in the house and active in the daytime when the men are away. He does not suggest what this cause may be but thinks that statistics on this matter should be carefully compiled to confirm or refute his opinion. Such an investigation may lead to the discovery of the real cause of the disease. Another interesting fact is that of the 36 males only 7 were between the ages of 20

(6) New Orleans Med. and Surg. Jour., September, 1911.

and 50, the ages when men are generally away from home in the daytime.

Maize Theory. C. C. Bass⁷ has applied the experimental method to the solution of the question of the etiology of pellagra in accordance with the maize theory. He assumes that the cause of the disease is microbic, but that it needs a soil of which maize, either good or spoiled, forms a part. The supposed organism was obtained by making bacterial cultures from the feces of pellagrins and selecting the products of these cultures on a maize-medium for feeding experiments on animals. The suspected material from the stools of pellagra patients was planted on a medium composed of corn-meal water and sufficient agar to make solid media. Nine cultures were obtained and each of these was inoculated on the media prepared as follows:

Corn, too green to shell, was "shucked" and dried in the sun until it could be shelled. After shelling, the grain was again dried in the sun until it could be ground into meal with a hand grist-mill. It was ground and the meal at once put into large bottles, moistened with water and sterilized in the autoclave. That the sterilization was complete is shown by the fact that a bottle of this meal has remained sweet and sterile for over three months. Bottles of this sterile meal were inoculated with each of the nine pure cultures referred to, incubated at 37° C. for three days and the feeding was then begun. Chickens, 2½ to 3½ months old, were selected. The spoiled meal was stirred into water, strained through coarse gauze and this fluid containing considerable fine meal was fed through a tube once a day. The dose given was the extract of about 10 to 20 gm. of meal a day. These chickens were given as much unpolished rice as they would eat all the time for thirty-eight days, after which their diet was changed to a good quality of cracked corn.

One fowl, No. 5a, fed on meal spoiled with Culture 5, has developed a condition very closely resembling pellagra in man. None of the others has developed such symptoms.

The fowl has had several attacks of diarrhea and has

(7) Jour. Amer. Med. Assoc., Nov. 18, 1911.

become very weak and emaciated. On the eighty-eighth day of the experiment, the legs below the knees were noticed to be red, inflamed, and bloody fluid was oozing through little cracks in the scaly skin. The skin became a dark brown color and on the seventh day began to show evidence of shedding around the edges in front. Five days after the lesions were first noticed the fowl was placed in a dark room and the spoiled meal discontinued. The shedding of this skin has progressed slowly and at the end of fourteen days the upper half of the legs in front had completely shed, when the fowl was sacrificed for permanent preservation. The skin where the lesions have shed has a lighter color than the normal and appears somewhat atrophied.

D. White⁸ reports what he believes to be the first case of pellagra occurring in Connecticut and the second in the New England States. The patient did not use corn in any form so that it would seem that this etiology could be with certainty excluded. She was, however, very fond of tropical fruits which she consumed to a large extent. The author suggests that an infection by means of these fruits may have taken place.

M. M. Smith⁹ urges that pellagra be made a reportable disease thus furnishing vital statistics and affording an opportunity for scientific investigation as to its nature and etiology. Further, an educational campaign should be waged by the national government, the respective state health departments where the disease exists, including the county and city health officers, for the education of the medical profession at large, so that they may be able to recognize the disease in its earliest stages and be prepared to administer the best possible treatment. Such educational work can be materially improved by well-arranged clinics through the various medical associations and schools and the presentation of suitable papers and their discussion in such organizations. In addition to these clinics, lectures should be held and wholesome literature for the people in general should be distributed so that the people may realize the value of healthy surroundings, the need of wholesome foods, the proper observance of rules of bathing, strict

(8) Jour. Amer. Med. Assoc., Apr. 27, 1912.

(9) West. Med. Rev., Apr. 27, 1912.

vigilance as to the quality of the corn preparations they eat, suitable screening for places of residence, and such other educational steps as will tend to better their condition, particularly that of the poorer classes, of whom the disease exacts its greatest toll.

G. M. Niles,¹ while admitting that the etiology of pellagra has not been worked out, is convinced that it is due to a chemical poison generated in spoiled maize and becoming active after being ingested. Its nature and course indicate that it is not contagious; an excessive fear of the disease is unreasonable and injurious. The nature of its onset and course indicates no need to hesitate to come into close contact with pellagrins and to permit attendants to do the same. Yet a pellagraphobia is manifest which needs to be checked.

This growing pellagraphobia is to a certain extent chargeable to the physicians who, either directly or by innuendo, set in motion such fears. Niles knows of a hospital which refuses to receive pellagrins on the ground that "it is an incurable disease," as if they had the prognostic functions of a supreme court.

Several months ago there was under the author's care a woman from another state who suffered from an extremely mild attack of pellagra. The report becoming rife in the family hotel where she was stopping that she had this trouble, such alarm was excited that the landlady was informed that unless this lady left, the house would become vacant. The patient was requested to seek another hotel, which she did.

It is the consensus of opinion among the majority of the thoughtful observers of pellagra that the most efficient prophylactic measures consist in avoidance of corn products, unless the corn is known to be sound, abstention from alcoholics of all kinds, reasonable care in eating, and all those hygienic precautions calculated to keep the body up to par and in a resistant state.

While pellagra is unpleasant to nurse and treat, the attendants should be reassured, for a little ripple of fear, if encouraged, may grow into a billow of huge proportions, engulfing a whole neighborhood or community. In addition, while it is of the utmost importance to the

(1) Jour. Amer. Med. Assoc., May 4, 1912.

patient that an early diagnosis should be made, the physician should be careful not to make a snap diagnosis on insufficient evidence. To diagnose as pellagra a sore mouth from pyorrhea alveolaris, an asymmetric skin lesion, an atypical gastro-intestinal disturbance, or some mental perversion, unless supported by other corroborative symptoms, is both unwise and unkind.

It is admitted that the specific etiologic factor in pellagra has not been traced to its lair. Until this factor is proved beyond a peradventure, there will necessarily be that element of uncertainty in which timid people will take no risks, keeping as far as possible on what they consider the safe side.

[The Illinois Pellagra Commission has made its report to the Governor. A condensed statement from this report will be published in *The Archives of Internal Medicine*. The experimental, clinical and laboratory work of the Commission seems to disprove the maize theory of causation of pellagra. Next year this volume of the *Practical Medicine Series* will contain an abstract of this report.—B.]

Mental Stress.² J. W. Preston calls attention to mental stress as a possible etiologic factor in the cases that develop among the well-fed who eat no corn. This may produce in the nervous system a fertile soil favorable to the development of the disease. This, however, must assume some cause not connected with the use of maize, since it is not to be supposed that mental stress would produce of itself so characteristic a train of symptoms as are exhibited by pellagrins.

Symptomatology. E. H. Inmon³ gives a good description of the symptomatology of the disease. It usually begins with gastro-intestinal disturbances followed shortly by an erythema, and in a brief while there is more or less involvement of the nervous system. It is a slowly advancing toxemia, the brunt of which, in the end, is borne by the nervous system, and each annual recurrence leaves a deeper and more indelible mark on the mental and nervous condition of the patient. The division into three stages, while artificial, is convenient and generally adopted. A patient may have suffered

(2) Jour. Amer. Med. Assoc., Dec. 16, 1911.

(3) Texas State Jour. of Med., October, 1911.

from pellagra for many years and still remain in the first stage of the disease; whereas another, in a much briefer period, may advance to the third stage.

First Stage. Prodromal symptoms are stated to be lassitude, vertigo, headache, general malaise, and perhaps mild digestive disturbances. There is a sensation of heat in the mouth and stomach, taste is altered, appetite is usually lost, and often ptyalism is present. The tongue is coated, and examination of the mouth often shows a redness of the mucous membrane, with vesiculation, or even superficial ulceration. Dyspeptic symptoms, with flatulency, are noted, and sometimes abdominal pain (usually epigastric). Occasional vomiting may occur, especially in alcoholics. Diarrhea is often present, and it, as well as the vomiting, may in some cases be of a spasmodic type. Sometimes it is dysenteric in character, muco-sanguinolent, with colic and tenesmus.

Muscular weakness, especially of the lower extremities, is usually evident early, and patients tire very easily. The temperature is usually normal, though there may be a slight evening rise. If there is much fever, complications should be sought for. The pulse may be accelerated, though at times it is slow. Functional heart murmurs may occur, but usually occur late. Vertigo is often present and very annoying. Headache, usually occipital, is frequent, and often severe. Rebellious insomnia occurs and various neuralgias are not seldom in evidence. Special stress is laid by some on spinal neuralgias, with cramp-like pains extending to the extremities. The knee-jerks at this stage may be exaggerated.

Intelligence, even at this early period, is often affected, and there is mild mental weakness with depression of spirits.

Ocular phenomena are sometimes present, inequality of pupils occasionally, dilatation often. Diplopia may occur. Cataracts are in some sections frequent, both in adults and children.

Second Stage. While erythema, digestive, and some nervous disturbances characterize the first stage, the second is marked by an aggravation of all these symptoms and the appearance of new and marked evidences of involvement of the nervous system which now dominates

the scene. The anemia increases, the loss of weight is apparent, greater physical weakness appears, the skin of the erythematous patches becomes thickened and covered with a hard, cracked, pigmented epidermis, sometimes of a yellowish color, usually brown. The stomatitis is aggravated, ulcerations are more frequent and, if not before, the tongue becomes now smooth and denuded of epithelium—the “bald tongue.” The diarrhea grows more persistent, sometimes sanguinolent, more often serous. The serous diarrhea is not seldom painless and is very persistent. If continued, it leads to the third state of cachexia.

Vertigo becomes more vague and prominent. Headache occurs with insomnia. Neuralgias are more frequent and severe. Psychic manifestations are seldom lacking, and have usually the character of melancholia; in mild cases there may be simply a mental feebleness, slow cerebration, with irritable depression and aversion to any activity. This may develop into stupor.

The gait is usually paralytic, occasionally paralytic-spastic, never, it seems, ataxic. Tremor of the upper extremities, head and tongue are recorded in many cases. The skin sensibility seems to be irregular and of no great importance. The tendon reflexes in some cases are normal, in most increased, and are sometimes weakened or lacking altogether. Differences in the upper and lower extremities and in the two sides are recorded.

Third Stage. This is really the terminal stage and is characterized chiefly by cachexia. The symptoms already described do not give place to new ones, but, on the contrary, they are present and aggravated. The cachexia now, however, stands boldly in the foreground, with dementia, paralysis, and other cerebrospinal phenomena still prominent in the picture.

There is an increasing marasmus, with marked anemia, atrophy of the subcutaneous fat and musculature, and a lack of resistance against intercurrent diseases. In addition there is great muscular feebleness, perhaps paralysis, including the bladder, and an uncontrollable, painless, serous diarrhea. Death follows, with the signs of heart weakness and its consequences, edema and effusions. Some intercurrent disease, such as acute tubercu-

losis of the lungs, which is common at this period, or septicemia, may close the scene.

Typhoid Pellagra. At this stage not infrequently the fatal termination may take place in what is called typhoid pellagra. The condition is described as one of profound prostration, dry tongue, fetid breath, continuous fever, feeble, small, perhaps irregular pulse, and frequently bed sores. The psychic condition becomes usually one of delirium, or perhaps partial stupor.

There is, in addition, a marked general neuro-muscular irritability. In spontaneous motion there is a perceptible tremor and a suggestion of inco-ordination. Speech is drawling, trembling, and frequently of a nasal quality. The head, through contraction of the neck muscles, is drawn backward, and now and then raised and moved convulsively from side to side. The facial expression is anxious and the facial muscles move with a tremor.

The lower extremities are found in a strong condition of extension, with plantar flexion of the feet. The tendon reflexes are increased and a simple percussion of the patellar tendon may result in a diffuse clonus of the entire limb, accompanied, perhaps, by a spasm of the whole body. There may also be present hyperesthesia and increased reflex irritability of all the sensory areas.

Pellagra is described as a feverless disease, but in this state fever is constant and often high. Roseola is lacking. In most cases death occurs in one or more weeks, often in a terminal bronchitis.

The Pellagrous Erythema. Erythema is the characteristic symptom of the disease. It makes its appearance almost invariably in the springtime, develops during the summer, and fades with the appearance of winter. It appears symmetrically and on the uncovered parts, selecting at first especially the extensor surfaces of hands and forearms, then the face, back of neck, upper chest, and dorsal surfaces of the feet. Later the flexor surfaces become involved, but the palmar and plantar surfaces usually escape.

Its relation to the sun's rays has been a subject of much discussion, but the most generally accepted idea is that the rays of the sun simply act as an exciting cause

in persons already victims of the disease. The skin in the beginning becomes red with sensations of burning and itching, and usually some puffiness is observed, all very similar in appearance to a marked sunburn. This red color disappears on pressure, but promptly returns when pressure is released. After some days bullæ may appear, and these may fuse into large plaques filled with serum or even sero-purulent or sanguinolent fluid. The edema may then disappear, the epidermis dries and falls in small, grayish scales. At other times the epidermis, after the initial redness described, is brownish or blackish chocolate-colored, or plum-colored, after which it dries and scales with no bullous formation.

After the first attack the skin remains pigmented for some time, and as repeated attacks occur it gradually undergoes chronic thickening with pigmentation, often of a dirty yellow, yellowish green, or bronzed color. The skin is then indurated, thickened, hard and rough. Later its elasticity partially disappears, the articular folds grow deeper, painful fissures and thick crusts may develop, or even small ulcerations after exfoliation. After repeated attacks the skin may become atrophic, thin and parchment-like, with almost entire loss of elasticity, and show whitish spots like the *striae gravidarum*.

It is to be noted that cases are described in which the erythema is wanting—*pellagra sine pellagra*. It seems, however, to be the general opinion that the absence of this symptom is only temporary, and that its final appearance can be looked for in all cases.

Pellagrous Insanity. In a few words, pellagrous insanity seems usually to be of the melancholic type. Acute maniacal spells may occur, however, with homicidal and suicidal impulses. Suicide by drowning is especially noted among the pellagrous insane. The general characteristics, otherwise, of pellagrous insanity seem not to differ greatly from those of other insanities.

The peculiarities of this disease on the plains, from the very few cases that have appeared there, seem to be that the disease is much more severe than in lower altitudes of Texas. The cases which have been observed presented all the usual symptoms, except one case, in which the patient's mind was not affected to within ten

hours of death. As a rule pellagra on the plains runs a short course, and very promptly terminates in death.

J. C. Johnson ⁴ considers pellagra to be a disease distinct from all others, and not acute in the sense that idiopathic fevers are. Its duration is strangely variable. Necessary to its development are certain positive conditions of the organism; chiefly a disturbance of inorganic balance. These conditions are emphasized with the progress of the disease. It often exists long before it is recognized or suspected. Gastro-intestinal symptoms are usually the first to appear, and are in proportion to the gravity of the attack. There is an absence of hydrochloric acid in advanced cases, and in many, a lack of ferments. The cases are treated successfully with chlorid of potassium, tincture of iron and essence of pepsin.

S. J. Meltzer ⁵ thinks that the facts that the serious cases of pellagra have no hydrochloric acid and that the cases that have hydrochloric acid have no serious symptoms indicate that the cause of the disease was of a kind that had to pass the stomach. If hydrochloric acid was present in sufficient strength there, the disease would not develop.

C. H. Lavinder ⁶ advises more extensive and more exact clinical observations on pellagra in the United States; to determine more clearly the value of data regarding the existence of symptom-complexes or diseases similar to pellagra; to appreciate at its true value what is meant by pseudo-pellagra; and to urge the need of careful studies on pellagra as seen in public institutions, especially in insane asylums. Such observations and studies would, he says, be of particular value in the United States, where the influence of the corn theory of the disease has no such weight, as it has especially in Italy, and where consequently individual observations can be made unprejudiced by the veneration of any particular etiologic school. Why, he asks, create a pseudo-pellagra? We may, with equal right, it would seem, create a pseudo-measles or pseudo-erysipelas or a pseudo-beriberi.

(4) Boston Med. and Surg. Jour., June 1, 1911.

(5) Ibid.

(6) Southern Med. Jour., Mar. 5, 1912.

Treatment. Diet. G. M. Niles⁷ regards some principles in the dietetic management of pellagra as different from those properly accorded to gastro-intestinal disturbances in other disorders. The consumption of whiskey made from corn and of corn starch have been taken as confirming the maize theory, and in the present state of our knowledge all corn products should be excluded from the diet. Flour was formerly adulterated with corn meal and although the pure food law has caused this custom to disappear, the possibility of its occurrence should be borne in mind. Such a contamination may occur in the kitchen if not in the mill.

The early diarrhea, Niles believes, is of central origin and for this reason it does not seem wise to cut down too greatly the daily amount of food, nor does a very limited dietary seem to exert any marked effect on the disordered bowels. The caloric needs of the patient should be supplied, and while woody vegetables should be excluded from the diet if there is diarrhea, care should be taken that their place is supplied by other articles of equivalent caloric value. Meat seems to be especially well-borne; tender broiled steak or roast beef may be given once or twice daily, or if the mouth is too sore to chew, either the scraped beef or that ground in a sausage mill may be given. Eggs are generally permissible, but in case of much flatulence only the whites should be given. Sweet milk is valuable when it agrees, but it sometimes produces flatulence or a feeling of weight in the epigastrium; peptonization sometimes relieves this difficulty. Buttermilk, or artificially soured milk, is a most useful article of diet.

When constipation is present, oatmeal, tender vegetables in purée form, thoroughly baked Irish, not sweet, potatoes, or cereals with but little sugar will aid the peristalsis of the intestines. Alcohol and the alcoholic proprietary food preparations should be avoided as a rule.

During the whole course of pellagra the patient should be nourished to the limit of assimilation, and in most instances the gastro-intestinal tract will care for

(7) Jour. Amer. Med. Assoc., Oct. 28, 1911.

more aliment than when similarly inflamed from other disease.

Cacodylate of Sodium. J. O. Elrod⁸ reports 4 cases treated with cacodylate of sodium by hypodermic injections of the sterilized solution in doses of three grains once in three days.

Soamin and Salvarsan. E. H. Martin reviews the specific treatment of pellagra and reports some observation on the reactions following salvarsan in syphilis and pellagra. He emphasizes the following points:

1. Soamin will relieve all of the symptoms of most cases of pellagra; it fails only when the condition of the patient is so feeble, complications so severe or the disease so aggressive that it cannot be given in sufficiently large doses. Usually it causes no reaction unless given in over 5-grain doses. Some cases would require more and could not stand the reaction from the endotoxins. Given in ordinary doses, it must be kept up for several years, the time yet uncertain. It is probable that if 10-grain doses were safe that there would be no relapse.

2. Salvarsan causes no symptoms if properly given to healthy people. In short, no disease germs, no reaction.

3. The fever following the administration of salvarsan to a case of syphilis is not due to the drug, but to the endotoxins, released from the killed germs; and is both diagnostic and prognostic.

4. The fever following the administration of salvarsan to a case of pellagra is not due to the drug, but to the endotoxins released from the killed germs, is also diagnostic and prognostic, and further proves beyond a doubt that pellagra is a parasitic disease caused by a micro-organism vulnerable to "606."

5. It is at least reasonable to believe that this organism is a spirochete or a spirillum.

6. The character of the reaction and the duration of the fever especially, show that the germs of pellagra are located principally in the brain and spinal cord.

7. The endotoxins released by the destruction of the pellagra germs are so highly toxic to the human host that the dose of the drug must be proportioned so as to

(8) Jour. Amer. Med. Assoc., Aug. 26, 1911. Digitized by Google

not destroy too many micro-organisms at one time, or the results may be disastrous to the patient. Observing patients given large doses of salvarsan, one can readily believe that in some cases a condition paralleling the so-called "congestive chill" in malaria might be produced.

8. Salvarsan does not cure pellagra in one dose, owing to the invulnerability of the germs at an early stage of development.

9. Prompt disappearance of symptoms shows that the older germs are killed.

10. Small and increasing doses, repeated within the time required for the development of the germs from the invulnerable stage to just before the stage of reproduction, give us a rational treatment for pellagra, and should offer as much certainty of a cure as quinine in malaria when properly given.

[We are not justified in theorizing about the effect of salvarsan upon the germs causing pellagra until it is proved that the disease is microbic in origin.—B.]

W. J. Cranston⁹ reports 3 cases of pellagra treated with salvarsan by Walker and Yarbrough in addition to 8 cases which he treated personally. Of the 11 patients 2 went on furlough clinically cured and have not been heard of since the opening of the present pellagra season. One was supposed to have been well until the nausea developed again. As stated this is construed as a return of pellagra; 3 have relapsed and have been treated the second time; one is unimproved; 4 are dead. Cranston believes that we have not yet found a cure for pellagra, although salvarsan has not yet been given a thorough trial.

DYSENTERY.

Intestinal Amebiasis. In the *local treatment* of this disease W. E. Musgrave¹ prefers thymol which he gives by enema in the following mixture:

	Gm. or c.c.
R Thymol	25
Alcohol	
Glycerine aa	250
M. et Sig.—Add 10 c.c. to each liter of water used in enema.	

(9) Jour. Amer. Med. Assoc., May 18, 1912.

(1) Jour. Amer. Med. Assoc., Jan. 6, 1912.

This gives a finished product of approximately 1 to 2,000 solution of the drug which, when the additional dilution formed by the bowel contents is considered, brings the actual intra-intestinal solution well within the antiprotozoal limits of the drug which is very actively amebacidal in 1 to 10,000 solution.

There does not appear to be any particular choice between the various quinine salts. The bisulphate is freely soluble and well adapted for use. The drug may be used in 1 to 1,000 to 1 to 500 aqueous solution depending on the irritability of the bowel. One of the principal objections to quinine is the constitutional effects often produced by its absorption from the bowel, particularly in patients who are able to retain enemas for considerable lengths of time.

Nitrate of silver frequently proves of decided benefit in solutions of from 0.1 to 1 per cent. in distilled water.

After describing the various other methods of treatment commonly recommended Musgrave concludes with the following general remarks:

Whatever the form of treatment used in amebiasis, the old adage to "treat the patient rather than the disease" applies with particular force. Amebaphobia and overtreatment are two important factors in preventing recovery. Amebaphobia may not be confined to patients, but too often it influences the judgment and actions of the physician in a way very unfavorable to the patient's best interest.

Overtreatment is a very common error and comes from the desire to destroy all the amebas, which is practiced without due regard to the patient's general condition and is no more consistent with good therapeutics than it would be to employ remedies in typhoid or pneumonia, looking primarily to the destruction of the micro-organisms causing these diseases.

It probably would be dangerous to consider any patient cured so long as amebas are discharged with the bowel contents, but with the patient in a satisfactory clinical condition this contingency should cause no particular alarm, because the accidents and complications of the disease are extremely rare in patients who have undergone a thorough preliminary treatment and whose clin-

ical condition is kept in a satisfactory state by subsequent intermittent treatment.

As to choice of the methods of treatment, each case must be a law unto itself. The irrigation treatment is the main reliance, particularly in what may be termed average or usual cases. Ipecac is particularly valuable in the presence of clinical dysentery and may be tried either alone or in combination with bowel irrigation. The substance used in enemas should be arbitrarily changed from time to time in cases in which satisfactory progress is not being made by any one method of treatment.

Bacillary Dysentery. A Bassler² makes the following deductions from bacterial observation of 4 cases of chronic dysentery of non-amebic nature:

1. There is a chronic form of dysentery due to the *B. coli communis*, and these cases are not uncommon in temperate climates.

2. The form of infecting organisms does not correspond to the Shiga or the mannite-fermenting types, and they are not possible of differentiation from the known forms of *B. coli communis* of high virulence.

3. The serums from the cases strongly agglutinated the organisms obtained from that person and more definitely than they did the strains of *B. coli communis* obtained from innocent sources.

4. The organisms were most fatal to lower animals, decidedly more so than in one's experience with the human *B. coli communis* ordinarily obtained and used in laboratory observations.

5. The organisms existed in large numbers in the lower intestinal tract of the cases, mostly in the mucus, and they are capable of destruction of tissue locally with the production of ulcers and then living within the tissue of the gut-wall in the bases of them.

6. In the etiology of these cases we are dealing either with a definite organism of the *B. coli* group, or with *B. coli communis* of a high virulence, strongly hemiparasitic in nature and from which the aggressin production is overwhelming and against the effects of which in sus-

(2) Med. Record, Oct. 7, 1911.

ceptible individuals the body cannot resist local tissue infection.

7. The clinical entity "chronic dysentery due to the *Bacillus coli communis*" seems warranted, and further there is reason for the belief that in the production of this disease we are dealing with an organism of the colon group specialized in nature.

Treatment of Bacillary Dysentery. F. S. Meara³ considers rest of first importance in the treatment of dysentery, especially a diminution of the activities of the large intestine. By putting the patient to bed we avoid the squeezing and massaging due to muscular action and so take away one stimulus of this function, upon which the frequency of the movements and the colicky pain so largely depend.

Diet. During the first few days of the attack, when the stomach is often very sensitive to food, and nausea and vomiting are a feature, and while the evidences of intoxication are most marked and peristalsis most active, the quantity of food is of less importance than the quality. The food must be bland, non-irritating and non-stimulating to the gastro-intestinal tract, must be readily assimilable and leave but little residue, and must be concentrated, especially with reference to its proteid content. All these conditions are met by milk better than by any other food.

When the temperature disappears and the stools have lost their diarrheal character, one may allow barley jelly, and thoroughly boiled rice; later, toast, then an egg, then a chop and then gradually the resumption of a normal diet. When, however, a case runs a chronic course, the same needs for sufficient foods to make good the body-losses prevail as in typhoid fever. All food should be given warm, for if cold or very hot, peristalsis is aggravated. Water should be given freely, as it must be appreciated that there is a constant great loss of water to the tissues. It should not be given too cold or in too large amounts at once. If there is much gastric disturbance, all foods must be stopped, until it is removed.

Drugs. A preliminary catharsis should be secured by calomel, salines and castor oil. If there is nausea and

vomiting accompanying the attack, calomel may be given in divided doses, gr. $\frac{1}{4}$ or gr. $\frac{1}{10}$ every ten or fifteen minutes until 1 or $1\frac{1}{4}$ gr. are given; then, if the stomach is quiet, give the oil, or failing that, salts.

Castor oil may be given as a tasteless preparation. An excellent method is to put a teaspoonful of brandy, whisky, wine, lemon-juice, orange-juice or peppermint water in a wine or egg glass, let it run all around the surface to wet it, then to pour on 5 teaspoonfuls of castor oil from a spoon previously wetted in hot water to let it run easily, and finally over the oil another teaspoonful of the same substance, and instruct the patient to take it quickly, wiping the lips and allowing him to suck an orange or lemon. The following prescription has been especially satisfactory.

R	Olei ricini.	10.
	Salol.	2.50
	Tr. opii deodorati	1.
M.	et Div. in capsulae no. xv.	
S.	One every two hours.	

One capsule is given every two hours and when the stools begin to diminish materially, one every three hours and with still further improvement one every four hours. The small dose of opium may be omitted; it does, however, add its own effect and relieves the pain.

There is one very important adjuvant to this treatment, also insisted upon by its advocates, namely, the administration every second day or at least every third day of further large doses of castor oil as in the beginning.

The small doses are unquestionably constipating, diminish the number of stools and improve their character. Fecal matter is constantly collecting, mucus, bacterial toxins and bacteria themselves are gathering, and damage from these sources with a recrudescence of the disturbance will follow unless evacuation is attained at suitable periods.

Symptomatic Treatment. Pain. This may be relieved by topical applications or drug administration. Heat to the abdomen is one of the best measures we have and can be applied in the shape of hot fomentations, turpentine stupes or thin poultices.

Tenesmus. The tenesmus frequently requires drug

treatment. This can be done by a suppository containing gr. ss of opium or in more severe cases by a morphine suppository which contains gr. ss, or by one combining opium and belladonna, *e. g.*:

R	Opil pulveris	gr. i.
	Ext. belladonnæ fol	gr. ¼
	Olel theobrom.	q. s. (gr. xxx.)
M.	et fiant talia suppositoria no. xii.	
S.	One inserted as directed.	

There are three things that should be emphasized about the use of opium in these cases:—

1. Never use it until the bowel has been efficiently emptied by one of the cathartics advised.

2. Use it in the smallest amounts that will get results. It is rarely necessary to use it in amounts greater than 1/10 of a grain, or one drop of the tincture every two hours.

3. Do not advise the patient of the fact that you are using it. The profound effects of opium that will permit him to appreciate that he is getting it will not be manifested in these doses.

Irrigation is to be done with the patient in the dorsal position with the hips elevated and on a douche-pan, or lying across the bed on a rubber-sheet so arranged as to form a gutter for the discharge of water. Sometimes the bowel is better filled by putting the patient on his left side and then turning him to his right, so as to seek the assistance of gravity in following the line of the colon. If the patient is fairly strong, the more trying knee-chest or elbow position may be used.

The tube should be long and soft; a rectal tube, a stomach siphon or a large rubber catheter will answer. The tube is warmed, lubricated and passed carefully into the bowel, as any roughness will cause a contraction and defeat the purpose. If it meets with obstruction, wait until the spasm ceases and then try again. If difficulty is met with let a little water pass in to distend the gut and try again. Pass it in eighteen inches or more.

[A rectal tube can not be readily passed more than three or four inches, without doubling up, in most normal individuals. In the knee-chest or in the Trendelenburg position, if air is permitted to distend the gut, a tube may be made to pass upward beyond the rectum

a variable distance. If the usual method of passing the tube is used it doubles up in the rectum, a fact which one may verify by passing the finger into the rectum alongside of the tube. Usually, therefore, the rectal tube is useless and harmful, especially in inflamed states of the bowel.—B.]

The irrigation may be followed by an astringent. The best astringent is silver nitrate. It should be used in increasing strengths, 1 to 2,000 at first, and increasing up to 1 in 500 or 1 in 400 or 300. Use one or two pints.

The treatment may be tried daily in the weaker solutions and then less frequently. Intermit the treatment occasionally to let the mucous membrane recover from any irritation by the silver that might have been excessive.

Ulcers. Protracted cases are often due to ulcers which will not heal under mild applications; hence, an effort should be made by the aid of the proctoscope or sigmoidoscope to detect and treat directly any ulcer within reach. Here silver in a 25-per-cent. solution may be used.

CHOLERA.

Treatment. N. Maldarescu⁴ discusses the treatment of cholera according to the various stages:

1. *Choleraic Diarrhea.* During the epidemic he recommends for the diarrheas which last for one, two or more days, calomel as follows: One grain of calomel mixed with an equal quantity of lactose and given in capsules or in sterilized water in two portions at half-hour intervals. The calomel acts as an antiseptic and bactericide as well as a cathartic. In this way the germs of the disease are swept out of the intestine as well as the toxins which have been secreted and which cause the inflammation of the intestine. The action of the calomel is immediately followed by an enema of sterilized water at 38° to 40° C. containing two grams of tannin per liter. The injections are made with an ordinary irrigator and with a tube 35 to 40 cm. long, provided with two openings. This is passed as deeply as practicable into the colon. The pressure of water is 60 to 80 cm.

(4) Wlen. med. Wochenschr., Aug. 5, 1911,

After two or three days the dose of tannin can be doubled. The injection should be continued twice daily as long as the diarrhea persists. The diet should be absolute, consisting of black tea, with lemon and some rum.

If the diarrhea persists the dose of calomel must be repeated. In addition to the calomel treatment that of Hayem may be applied. This consists of a 5 to 15 per 1,000 solution of lactic acid in simple syrup. Opium preparations are best avoided as they tend to check peristalsis and favor the retention of pathogenic germs. If it is desired to use opium the author recommends the following mixture:

R	Tinct. cinnamomi	10
	Menthol	5
	Tinct. opii	5
	Tinct. rhel	10
M.	Sig. Take 15 to 20 drops hourly.	

In this stage of the disease the patient should remain quiet in bed and be isolated as much as practicable, and all rules for disinfection of the stools and linen should be carefully followed. If the treatment is followed by the recovery of the patient he should not be dismissed from observation until bacteriologic examination of the stools during convalescence indicates the complete absence of the cholera vibrio.

2. *Cold Stage. Cholera Algida.* Rice stools, repeated vomiting, cramps, and algid fever are the certain signs of an attack of cholera. In this stage the patient is usually brought into the hospital. Here he is immediately put in a warm bed and by the application of external warmth and warm baths, to which from 200 to 300 grams of mustard have been added, an attempt is made to restore the circulation. Each bath should continue twenty minutes and should be given once in two or three hours. In place of the baths massage with various irritating agents to arouse the circulation in the skin may be applied.

The taking of any sort of drink is strictly forbidden. At the most the moistening of the mouth with cold liquid in very small quantities is permissible. For the quenching of the thirst and compensating for the liquid which is lost through the frequent passages enemata

with sterilized water at 30° to 40° C. may be given every three to four hours. The tube of the syringe should be 40 to 45 cm. long. For every injection a liter of water is used. Cantani recommends for this purpose the following solution: Boiled water at 38° C., 2 liters; tannin 8 grams; acacia, 50 grams; tinct. opii, 20 to 30 drops. This solution is used for two enemata that are made with an esophageal tube by which the liquid can be introduced up to the cecum or even be made to reach the small intestine. These enemata may also be made with tannin alone.

[The length of the tubes has probably no significance as to the distance to which the liquid will reach. A tube which is introduced into the ampulla of the rectum is entirely sufficient.—S.]

The author recommends the following for vomiting: A solution of creosote, 20 drops in 100 c.c. of water and a stovain solution, 1 gram in 10 grams of menthol, given hourly in doses of 15 to 20 drops; or a solution of stovain in chloroform, 1 gram of stovain in 10 grams of chloroform, also given in drops. An ether spray on the epigastrium or a mustard plaster may be applied. For persistent vomiting stomach lavage is undertaken. Delpeuch uses for this a 10 to 15 per 1,000 solution of lactic acid. Hayem and Lesage use sterilized water or a 2-per-cent. boric acid solution.

To obviate the concentration of the blood resulting from the excretion of liquid, intravenous injections of physiologic salt solution under aseptic precautions are especially valuable. Maldarescu recommends the following solutions: Sodium chlorid, 7.5 grams, sodium sulphate, 2.5 grams, in 1,000 c.c. of distilled water. The injections are made into the vein of the elbow. For a single injection at the most, 1,500 c.c. of liquid should be used with pressure obtained by an elevation of 1.2 meters above the bed. The liquid should flow slowly, at the most 20 c.c. per second, and the temperature should be 37° to 38° C., or in dangerous cases 40° to 42° C. In very serious cases the intravenous infusion may need to be repeated several times in twenty-four hours. Without doubt the use of hypodermic and intravenous sodium chlorid injections is the most powerful remedy.

against the algid fever and other disturbances of the organism in cholera cases which for the most part end in collapse or death. The serum therapy of cholera has so far a purely theoretic value.

3. *Period of Reaction.* When a reaction occurs the danger in general is not past. Often the reaction is only partial and leads to relapse or hyperthermia. The patient should be kept in bed and the diet should be carefully controlled. After two or three days some warm, sterilized milk may be added to the tea. Ten drops of tincture of nux vomica may be given twice daily as a stimulant to the gastric mucosa. On the fourth day a liter of fresh skimmed milk may be given in portions of 150 c.c., at intervals of every three hours. During convalescence complete rest in a well-aired room should be recommended. Solid food should be very gradually resumed.

For the treatment of carriers the author recommends the occasional administration of calomel, and in the interval the use of tannin in small doses, two or three times a day.

SYPHILIS.

Localization of Spirochetes in the Heart. A. S. Warthin and E. J. Snyder⁵ report 2 cases of congenital syphilis in which *Spirochaeta pallida* was demonstrated in the heart muscle on microscopic examination. The patients died, one at the age of nearly three months, the other at the age of eight days. The first child died of inanition, the second of asphyxia. The second child presented a papular eruption and developed snuffles a few days after birth. Histologic lesions or spirochetes were not found elsewhere in the body. The heart in both cases presented evidence of disease of the myocardium.

The authors remark that the two cases are important for a number of reasons. They throw light in a unique way, on the important question of the localization of spirochetes within the body, and the "concentration" of the infection in a single organ or tissue. The fact that the heart may show marked lesions in cases of congen-

(5) Jour. Amer. Med. Assoc., Mar. 9, 1912, Digitized by Google

ital syphilis when the liver, lungs and spleen show no changes at all and no spirochetes, has a great practical importance in pathologic diagnosis, since in ordinary routine work signs of congenital syphilis are usually looked for in these organs alone. These cases also add emphasis to the view, expressed by Warthin, that the heart-muscle is a favorite place for the colonization of the *Spirochæta pallida*, and that the microscopic signs of such a localization may be so slight that the question of syphilis can be determined only by the demonstration of the spirochetes.

Symptomatology. *Early Nerve Involvement.* J. G. Harkness⁶ reports a case of syphilis in which salvarsan was administered for hard chancre, resulting in the disappearance of the sore in a couple of weeks. This was followed by about one month's course of mercury. In about five months after the appearance of the primary sore symptoms of nerve involvement appeared affecting both lower extremities which became completely paralyzed. The patient developed very severe headache. The pupils were dilated, sluggish and he could not see to read. On mercuric iodid and potassium iodid with massage to the lower extremities he rapidly improved so that in two months he could walk unaided.

Diagnosis. *Noguchi Method.* J. H. Black records his experience with the Noguchi reaction for syphilis which he finds, if anything, more sensitive and fully as reliable as the Wassermann reaction. The comparative simplicity of its technic commends it to the laboratory man in small cities or towns, to those who make only occasional tests, and to those who have not access to a fully equipped laboratory.

Laboratory Methods of Diagnosis. L. S. Schmidt⁷ discusses the laboratory diagnosis of syphilis. The author's method of treating smears is as follows: The smears are first fixed in the fumes of osmic acid, then immersed in a weak solution of potassium permanganate as a mordant, washed in distilled water and covered with Giemsa stain diluted 1 to 10. They are heated on a copper plate for twenty minutes; the slides are then washed

(6) Jour. Amer. Med. Assoc., Feb. 17, 1912.

(7) Jour. Amer. Med. Assoc., Nov. 18, 1911.

in distilled water and dried in the air. By this method the treponemas are stained deep purple.

Stearns' silver method stains the treponemas a deep black but distorts their outline somewhat. In addition, it is very difficult to obtain a solution of silver nitrate that will not precipitate a granular film on the smear.

Another method generally used on account of its extreme simplicity and rapidity is that described by Burri in 1909, commonly known as "the India ink" method. A loopful of serum obtained from the lesion is mixed with a loopful of good India ink, preferably the Chin-Chin liquid pearl ink, and the mixture is rapidly spread over the slide as in making a blood-smear. After the film dries it is examined under an oil immersion lens, without mounting. The field appears as a brown or black background in which the treponemas, blood-cells, etc., stand out as colorless refractive bodies. Objection has been raised by Barach to this method. He states that certain inks contain extraneous fibrils which resemble in form the treponema. Schmidt has never noticed this, but the fact that the presence or absence of the treponema must be determined not by finding the micro-organism but by seeing the unstained space which it occupied and that these spaces are often distorted in shape, appears to be a valid objection to this method.

The *Treponema pallidum* and the *Spirochaeta refringens* can easily be differentiated by this method, but it is impossible to distinguish between the *Treponema pallidum* and the *Treponema dentium*. This applies, however, only to smears taken from lesions of the mouth.

By far the best method of finding *Treponema pallidum* is in fresh preparations by means of the dark-field condenser. When using this method as well as when making smears, great care must be taken in obtaining the material. No antiseptic solutions should be used prior to the examination. In primary lesions the surface is first washed with normal salt solution, and anesthetized, if necessary, with novocain and epinephrin, locally. The entire indurated area is then picked up with a long-pointed hemostat and squeezed until the tissue becomes blanched. Then the surface is scraped until a clear serum exudes, and from this serum the slides or smears

are made, diluting with normal salt solution if necessary.

For those working continuously with the complement-fixation reaction, there appears to be no advantage in the use of antigen and amboceptor dried on filter paper. Experiments with these papers, when controlled with liquid reagents, have shown that those papers impregnated with antigen will not keep as long as a liquid extract maintained in the ice-box.

The usual methods of examining cerebrospinal fluid for the purpose of determining the presence or absence of syphilis are, cytologic examination, the Nonne ammonium sulphate reaction, the Noguchi butyric acid reaction and the complement-fixation reaction. In the main, these reactions have their greatest value in patients suspected of having tabes, cerebrospinal lues, general paresis, and in psychiatric cases. In using the Nonne reaction Schmidt uses the ring method of Ross and Jones. In the butyric acid test care must be taken that the butyric acid is fresh and that only a flocculent precipitate, which appears within two hours after heating, is called positive. In carrying out the complement-fixation reaction with the cerebrospinal fluid, it has been found by titration that an amount equal to ten times the quantity of blood-serum must be used. The presence of a positive Nonne and butyric acid test indicates an increase in the globulin content of the cerebrospinal fluid, and may be obtained in cases of acute inflammatory meningitis. In tabes Schmidt obtained positive reactions in the cerebrospinal fluid, while the reaction on the blood-serum was negative. This result has also been obtained in several cases of cerebral syphilis.

Ascoli and Izar utilize the fact that when a specific antigen and a serum containing its corresponding antibody are mixed a lowering of the surface tension of a drop results. This phenomenon has been utilized in the diagnosis of syphilis by first determining the number of drops in a given bulk of the patient's serum, and then determining the variation from that number after the antigen has been added to a like quantity. Schmidt's experience with the stalagmometer of Traube leads to the conclusion that this instrument is too delicate for the use of the general practitioner. The surface tension

is changed by many factors, such as vibration, temperature, specific gravity, etc., making it of little use outside of a well-equipped physical laboratory.

1. Examination by the dark-field condenser is the surest and most rapid method of determining the presence or absence of the *Treponema pallidum*.

2. The success with fresh specimens and smears depends largely on the care used and the manner of making the preparations to be examined.

3. The early diagnosis of syphilis becomes more important on account of the advantage obtained in aborting the disease in many instances by the use of salvarsan.

4. Serum diagnosis of syphilis is of great value throughout the course of the disease after the infection becomes systemic.

5. The complement-fixation reaction is of value in determining a syphilitic etiology and the effect of treatment.

6. In patients under treatment a negative complement-fixation reaction is not of the same value as a positive one in determining the presence or absence of the disease.

7. In certain forms of parasyphilis a negative reaction does not entirely exclude the presence of syphilis.

8. In syphilis of the central nervous system the complement-fixation reaction should be done with the cerebrospinal fluid as well as with the blood-serum.

9. Great care should be taken in selecting and making antigens used in the complement-fixation reactions. The reaction is a quantitative one and the accuracy of results are dependent entirely on the quantitative relation between the various reagents.

10. With properly selected antigens the Wassermann and Noguchi methods are equally reliable.

The Wassermann Reaction. While the Wassermann reaction is now accepted as a reliable test for the presence of syphilis L. Newmark⁸ reports 2 cases in which the reaction, while probably indicating the presence of syphilis, formed the basis of an incorrect conclusion as to the nature of the lesions present. In the first case a carcinoma of the breast was accompanied by evidences of a tumor of the brain. The occurrence of carcinoma

in the breast made it probable that the tumor in the brain was also carcinomatous. The absence of palpable metastases and the positive Wassermann reaction led to hesitation with reference to the removal of the cerebral tumor, yet had not the tumor in the breast been present an attempt would have been made to remove the cerebral tumor. Its localization was certain and it seemed easy of access. A right hemiplegia gradually developed and the patient failed rapidly and died. Necropsy showed that the tumor of the brain was a gliosarcoma. The cerebrospinal fluid from the cranial cavity gave a positive Wassermann and a strong reaction with Noguchi's butyric acid test. There was no trace of syphilis in the brain.

The second case presented a gradual development of symptoms of compression of the spinal cord with a positive Wassermann reaction in the blood-serum and also in the cerebrospinal fluid. By operation an intradural psammoma was removed and the reaction in the cerebrospinal fluid procured during the operation was negative. A subsequent examination of the blood-serum gave a negative reaction. In this case specific treatment was continued for some time without effect on the symptoms of compression of the cord. Consequently operation was resorted to. The author feels that such experiences justify a disinclination to regard a positive Wassermann reaction as absolutely decisive. The cases quoted illustrate the possible fallaciousness of a diagnosis *ex juvenibus*, so that it is extremely urgent that whatever uncertainties attach to the practice of the Wassermann method should be eliminated.

C. F. Craig and H. J. Nichols⁹ record certain observations regarding the effect of the ingestion of alcohol on the Wassermann test. They have found that alcohol, when taken in considerable quantities, possesses the power of rendering the strongest positive serum negative, and that this negative reaction persists for a few hours to several days. These observations are of both practical and scientific interest. From the practical standpoint they demonstrate that no dependence can be placed on a negative Wassermann reaction in individuals

(9) Jour. Amer. Med. Assoc., Aug. 5, 1911.

who have within twenty-four hours of the collection of the blood, ingested considerable amounts of alcohol, while in some instances the drug may render the reaction negative for as long as three days. Careful inquiry, therefore, should be made regarding the recent ingestion of alcohol before collecting serum for the complement-fixation test in lues.

Luetin Reaction. H. Noguchi,¹ having found a way to secure pure cultures of the *Spirochæta pallida*, has produced from these cultures a substance similar to tuberculin which he calls luetin. By using this in a manner similar to the reaction of von Pirquet with tuberculin a specific reaction is obtained in those who have had syphilis which bids fair to constitute a diagnostic method equal in significance and easier in application than the Wassermann reaction. The extract is prepared from at least six different strains of the *Spirochæta pallida*, thus securing a polyvalent antigen. Noguchi has met the following types of reactions:

Normal or Negative Reactions. In the majority of normal persons, there appears, after twenty-four hours, a small erythematous area at and around the point of injection. No pain or itching sensation is experienced. This reaction gradually recedes within forty-eight hours and leaves no induration. In certain individuals, the reaction may reach a stage of small papule formation after twenty-four to forty-eight hours, after which and within seventy-two hours it commences to subside. No induration is left behind, although occasionally slight yellowish pigmentation may result from mild ecchymosis.

Positive Reactions. A. Papular Form: A large, raised, reddish, indurated papule, usually from 5 to 10 mm. in diameter, makes its appearance in twenty-four to forty-eight hours. The papule may be surrounded by a diffuse zone of redness and show marked telangiectasis. The dimensions and the degree of induration slowly increase during the following three or four days, after which the inflammatory processes begin to recede. The color of the papule gradually becomes dark bluish-red. The induration disappears within one week, except in

(1) Jour. Amer. Med. Assoc., Apr. 20, 1912. Digitized by Google

certain instances in which a trace of the reaction may persist for a longer period.

B. Pustular Form: The beginning and course of this reaction resemble the papular form until about the fourth day, when the inflammatory processes commence to progress. The surface of the indurated, round papule becomes mildly edematous, and multiple miliary vesicles occasionally form. At the same time a beginning central softening of the papule can be seen. Within the next twenty-four hours, the papule changes into a vesicle filled at first with a semi-opaque serum that later becomes definitely purulent. Soon after this, the pustule ruptures spontaneously or after slight friction or pressure. The margin of the broken pustule remains indurated, while the defect caused by the escape of the pustular content becomes quickly covered by a crust that falls off within a few days. About this time the induration usually disappears, leaving almost no scar after healing. There is a wide range of variation in the degree of intensity of the reaction described in different cases, as some show rather small pustules, while in others the pustule is much larger. This reaction was found almost constantly in patients with tertiary or late hereditary syphilis.

C. Torpid Form: In rare instances, the injection-sites fade away to almost invisible points within three or four days, so that they may be passed over as negative reactions. But sometimes these spots suddenly light up again after ten days, or even longer, and progress to small pustular formation. The course of this pustule is similar to that described for the preceding form.

This form of reaction has been observed in a case of primary syphilis; in one of hereditary syphilis, and in two cases of secondary syphilis, all being under mercurial treatment.

Neither in syphilitics nor in parasyphilitics did a marked constitutional effect follow the intradermic inoculation of luetin. In most positive cases, a slight rise in temperature took place lasting for one day.

Treatment. *Salvarsan.* J. T. Gerachty and A. Keidel² conclude as follows regarding the value of sal-

(2) Jour. Amer. Med. Assoc., Nov. 18, 1911.

varsan: From our experience with this drug, we are convinced that it is an important addition to the therapeutics of syphilis. In almost every case in which visible lesions were present complete disappearance followed the injection, and marked improvement in the general condition of the patient was a constant feature. In all cases refractory to mercury, the response to salvarsan has been prompt and striking. The drug is indispensable for the treatment of patients who do not tolerate mercury. A study of our statistics does not warrant us in expecting a complete cure of syphilis and absolute immunity from recurrences in the majority of cases after the use of only one or two injections. A small number of cases which have been followed for four or five months without recurrences justifies the belief that one injection of salvarsan will effect a complete cure in some cases. Salvarsan is without doubt of equal value with a long course of mercury and potassium iodid in the cure of lesions. It has, however, the very great advantage of simplicity of administration, and causes the lesions to disappear with great rapidity. Moreover, it saves the patient from the damage done by the luetic toxin during the period necessary for the control of the disease by means of mercury.

Emphasis is laid upon the fact that the use of salvarsan has now passed beyond the experimental stage. One should no longer make it his object to see how much good can be done with one or more injections of this drug, but rather how much value it can be made to assume in the treatment of syphilis when combined with other drugs.

From their experience at present, the authors strongly advocate a vigorous course of mercury following the injection of salvarsan, continued for about six months and possibly then followed by another dose of salvarsan. In the primary cases, and those already well under control with mercury, it seems fairly probable that salvarsan may be sufficient to eradicate the disease.

Disadvantages of Salvarsan. D. W. Montgomery³ enumerates a number of the inconveniences of salvarsan mostly complicating the subcutaneous or intramuscular

(3) Jour. Amer. Med. Assoc., Nov. 18, 1911. Digitized by Google

administration. He also mentions thrombosis which may arise from blood clotted by flowing through a rusty needle and reinjected into a vein. He has also seen thrombus of the vein, presumably from the mere injury of the operation. The only symptoms were edema of the arm with some functional incapacity, and a cord-like hardening that cleared up in a short time. An annoying feature, although a fleeting one, is the severe pain at the shoulder that patients often complain of after about 100 c.c. are injected. This may necessitate stopping the injection for a few moments in order to allow the circulation to readjust itself.

What is called a Herxheimer arsenical reaction may occur on the skin in the course of the first few days. It is a bright red erythema, usually best observed on the trunk, and Montgomery has never seen it give rise to any further disturbance. It is as well to know of its existence, however, as misunderstandings may otherwise occur.

The salvarsan reaction in the syphilitic lesions themselves is highly important. When, for example, there are a great number of very active syphilitic lesions, as in early malignant syphilis, the temperature reaction may run as high as 105° F. It is, therefore, important to be careful when there are many lesions, and when there is a low cachectic condition. Montgomery has never seen any death arise from this source, but at times there are serious inconveniences. In such cases Schreiber advises giving half the usual dose, followed in a week by the other half. Usually, the temperature reaction comes on quite early in all syphilitic lesions excepting those of the central nervous system. The temperature reaction in lesions other than those of the central nervous system occurs at about four or five hours after the injection, while in lesions of the central nervous system it occurs at about from eight to ten hours afterward. This difference is so regular in its occurrence that it may be used for diagnostic purposes. When no syphilis is present, no temperature reaction occurs. The experience of Schreiber is particularly interesting in this respect. Knowing how frequently arsenic is prescribed in psoriasis, and how excellent the results sometimes are,

and knowing also that in many instances the favorableness of the result bears some relationship to the size of the dose, he hoped to achieve success in psoriasis by injecting salvarsan which contains such an enormous quantity of arsenic. The psoriatic patients injected showed no temperature reaction whatever, nor had the drug the least effect on the eruption.

There is not alone a temperature reaction in cases of syphilis in which salvarsan is injected, but there is a marked reaction in the lesions themselves. They become redder and more swollen. The drug acts in this respect somewhat like tuberculin in tuberculosis. As may readily be seen, this is an important matter when it comes to the question of administering salvarsan where the affected organ is of great dignity, as in cases of gumma of the heart or of the brain. If a patient has gumma of the brain, from which he is suffering severely from the pressure of the tumor, the sudden enlargement of this tumor, consequent on the local reaction, may be of the greatest importance. For the same reason, if a patient has gummatous softening of an artery, giving rise to an acutely dilating aneurism, a dose of salvarsan by increasing the quantity of blood sent to the part may cause irremediable damage. The action of mercury and of potassium iodid is quite a contrast to this, as under these remedies there is no increased afflux of blood to the affected part, but rather a slow melting down of the syphilitic infiltration. Of course, in a patient suffering with aneurism the drug would not be administered intravenously, as the fluid itself would dangerously raise the arterial pressure.

Finally we come to a disadvantage in the administration of salvarsan, which may count for nothing in an altruistic or scientific sense, yet from a practical point of view is of great importance. It is not a remedy to use in office practice or in an ambulatory clinic. The patient should be sent to a hospital, and this in itself constitutes an expense which many patients cannot afford. Even when given intramuscularly or subcutaneously, the administration of salvarsan consumes considerable time, and the physician's time counts for something. When given intravenously a very considerable amount of time is consumed, as the administration amounts to a surgical

operation, making its administration still more expensive. This expense the patient might cheerfully undergo if the physician were able to assure him that his troubles would thereby be ended, but we are far from being in a position, even after several injections of salvarsan, to assure the patient that he is permanently cured. In the present state of our knowledge, we still are compelled to advise the patient, although he has taken salvarsan, to take mercury and potassium iodid also.

An enumeration of the disadvantages of this new drug serves only to throw into still bolder relief its great advantages. The wonder grows that such a powerful spirillicide can be thrown in such quantities into the circulation with such little risk to the host. In contemplating this marvel, we begin to appreciate the fine scientific imagination of the man who made this possible.

RELAPSING FEVER.

Treatment by Salvarsan. Ardin-Delteil, L. Negre and M. Reynaud⁴ report favorable results from the employment of salvarsan in the treatment of relapsing fever. They found a fall of the fever with a remission or disappearance of the symptoms of the infection. They employed doses of 0.6 gm. (10 grains) because they felt that it was important to act at once on the spirilla with massive doses of the remedy. The spirilla, like other protozoans, are apt to acquire an immunity against remedies which are used in small doses. It has been observed that the spirilla of a relapse are to a great extent immune to the spirillicide principles in the blood of the patient undergoing a relapse. They noted, secondly, that in both patients the intravenous injection was not followed by any immediate effect but in the later periods the symptoms were quite different in the two cases. In the first patient there was no reaction to speak of except vomiting which occurred two hours after the injection. In the second case, on the other hand, there was an intense reaction characterized by a very marked elevation of temperature, by chills, trembling, extreme agitation, nausea, bilious vomiting and a profuse

diarrhea. These symptoms the authors are inclined to attribute to the action of toxins set free by the destruction of the parasites by the salvarsan. The difference in the reaction might be explained by the more advanced stage of the disease in the case which reacted violently. From this case the authors draw the conclusion that the remedy should be given as early as possible after the inception of the disease. The authors feel sure that a specific remedy has been discovered for a disease which has heretofore resisted all attempts at specific treatment.

MEASLES.

Etiology. Transmission to Apes. F. Anderson and J. J. Goldberger showed that it was possible to transfer measles from human patients to the monkey by injection with the blood. The success was only partial since of the 9 animals inoculated only 2 gave an unmistakable reaction. Two others gave reactions that were regarded as significant, while in the remaining 5 a reaction was either not appreciable or at most only suggestive. The authors were disposed to attribute this relative failure to a low degree of susceptibility in the monkey, but inasmuch as the successful case resulted from the injection of blood taken between fourteen and eighteen hours from the first appearance of the eruption the authors surmised that in measles we have a disease in which the infectivity of the blood is limited more or less sharply to the early stages, somewhat as in yellow fever.

The resemblance of the temperature curve of yellow fever to that of measles had already struck them. They accordingly secured blood from a patient on four separate occasions. The first bleeding was a few hours before the eruption began to appear and while the patient's temperature was between 101° and 100° F. This blood after defibrination, was inoculated into two monkeys which gave short but definite reactions that were at their height ten days after inoculation. The three monkeys inoculated with this specimen gave well-marked reactions. The third bleeding was successful in the same manner. The inoculation of blood from the fourth bleeding failed.

Taking the results obtained from inoculations with human blood from six cases the authors conclude that the period of infectivity of the blood begins just before and continues for about thirty-four hours after the first appearance of the exanthem. Hektoen found the blood infected thirty hours after the first appearance of the rash in experiments on man, but man is a more susceptible animal than the monkey. The existence of a more or less definitely limited period of infectivity of the blood in measles, strongly indicated by these experiments, would explain both the negative and the positive results of monkey inoculations reported by Josias in 1898, would throw light on the reported failures of subsequent workers and would therefore, make intelligible the opinion, almost universally held previously, that the monkey is not susceptible to measles.

In a later communication J. Goldberger and J. F. Anderson report experiments which tend to show that the mixed buccal and nasal secretions are certainly infective at the time of the first appearance of the eruption and also forty-eight hours later, that is, on the fourth and the sixth day of the disease; and that this infectivity is due to a living virus susceptible of transfer from monkey to monkey by a blood inoculation. In view of the author's experience that a rapid reduction in the virulence of the blood sets in at the end of about twenty-four hours from the first appearance of the eruption, it would seem that the duration of the full infectivity of the blood does not run parallel with that of the mixed buccal and nasal secretion.

In a third article these authors discuss the nature of the virus of measles. They have examined it as to filterability, drying, heat, freezing and age. They summarize their conclusions as follows:

1. The virus in the blood from a case of measles may pass through a Berkefeld filter, resist desiccation for twenty-five and one-half hours, lose its infectivity after fifteen minutes at 55° C., resist "freezing" for twenty-five hours, and possibly retain some infectivity after twenty-four hours at 15° C.

Incubation Period. R. Hecker⁵ tabulates the find-

(5) Zeitschr. f. Kinderheilk. II. No. 1, pp. 1-122.

ings in 14 children whose blood was examined during the incubation period of measles. The temperature was found to vary widely even in the earliest stages and the blood showed pronounced reduction of white corpuscles, fully four and one-half days before the eruption and three and one-half days before Koplik's spots were manifest. Two or three days before the eruption the leukocyte count increased. In one of the cases the period of incubation was sixteen and in another twenty days. The tables confirm the resemblance between measles and serum sickness after the first injection, both a specific reaction, of the same type.

Pathology. Ludwig Hektoen and H. E. Eggers⁶ have made a special study of the leukocytes of monkeys after inoculation with measles. The general results of their experiments agree very well with those of Anderson and Goldberger. The combined results indicate that *Macacus rhesus* is susceptible to a mild kind of measles if injected with the virus of human measles present in the blood soon after the rash has appeared.

Their observations show that in measles of the monkey, the leukocytes appear to behave very much as they do in human measles; that is to say, that preceded by a more or less distinct leukocytosis there occurs a leukopenia of variable degree in what would correspond in a general way to the latter part of the pre-eruptive and early part of the eruptive periods. In their animals this leukopenia involved principally the neutrophiles, the lymphocytes being relatively somewhat increased.

Inasmuch as these monkeys, at the same time as they received the measles virus, also received a large amount of foreign protein in the form of human blood, it is of course questionable whether the changes in the leukocytes should be attributed to the action of the measles virus only. It might be said that the leukopenia is one of the results of the introduction of human blood and connected with the resulting processes of antibody formation and sensitization. While further observations are necessary in order to settle this point, it may be said that in monkeys injected with human blood for other purposes and in larger quantities than those used in these experi-

ments, the authors have noted either no leukopenia at all or only slight and transitory diminutions in the counts. Hence it may be concluded that the leukopenia observed in Monkeys 5 and 10, and to a less degree in Monkey 2, most likely represents a reaction to the measles virus.

Prophylaxis. P. Brooks⁷ writing of the control of measles, concludes as follows: The organism which causes measles has not yet been discovered, but, reasoning by analogy, it may be assumed that it lives for a very short time outside the living body. Measles is practically always communicated through the presence of an infected person; rarely, if ever, through a third person, clothing, or house infection. It is infectious from the beginning of the catarrhal stage. Our present efforts to control it do not give satisfactory results, chiefly because we permit the cases in the catarrhal stage to go undetected. If it is to be controlled or prevented, it must be through isolation upon the appearance of the first symptoms.

DIPHTHERIA.

Prophylaxis. S. R. Catlin, L. O. Scott and D. W. Day⁸ report a small epidemic of diphtheria in a Rockford hospital which resulted in 31 per cent. of the population affected remaining carriers. The ordinary antiseptics being inefficient to rid the throats of these persons of diphtheria bacilli, spraying the throat and nose with a twenty-four hour old bouillon culture of staphylococci according to the method of Schiötz was undertaken with success. The authors present the following conclusions:

1. The ordinary immunizing dose of diphtheria antitoxin does not always protect an exposed individual against the disease.
2. Only by regular and constant taking of cultures can institutional epidemics of diphtheria be controlled.
3. The usual methods of throat antiseptics are of little value in ridding the throat of diphtheria bacilli.
4. Treatment of the nose is as important as treatment of the throat.

(7) Med. Record, Dec. 23, 1911.

(8) Jour. Amer. Med. Assoc., Oct. 28, 1911.

5. In institutional epidemics, more than one series of three negative cultures is necessary for release.

6. Results with *Staphylococcus aureus* spray were such as to warrant recommending its further use.

7. Apparently, no harm results from the application of the spray.

Diagnosis and Treatment. A Levinson⁹ gives the following practical points in the diagnosis and treatment of diphtheria: Besides the laboratory diagnosis of diphtheria there are several clinical points that hold good in most cases and that help in establishing the diagnosis of the disease.

1. Diphtheria Smell: A diphtheria case gives a very characteristic odor like that of feces. When one once becomes accustomed to the odor, one can easily detect a diphtheria case at a distance of two feet. It is really surprising that clinicians who have written on diphtheria have never made any mention of this diagnostic point. The odor is most pronounced in nasal cases and less so in tonsillar, but is present in all cases. A clinical diagnosis can be made in all cases from the odor.

2. Temperature: Any case of sore throat with a temperature higher than 101.5° F. can safely be put down as a case of tonsillitis. No case of diphtheria runs up a temperature above 101.5° F. A very severe case, especially if it is a nasal one, shows hardly any rise in temperature, most nasal cases having but 99° F. It frequently happens that the administration of antitoxin raises the temperature to about 102° F. or more, but this disappears in a few hours. On the average the temperature in diphtheria is as follows: Tonsillar, 101° F.; pharyngeal, 101.5° F.; nasal and laryngeal, 99° F.

3. Membrane: Though no positive diagnosis can be made on the presence of a membrane, it can be taken as one of the best clinical diagnostic points in diphtheria. When a membrane appears on the tonsils, uvula, or posterior nares, one can safely diagnose the case as one of diphtheria. The absence of a membrane does not exclude diphtheria but its presence speaks for it. As stated before, however, if caustics have been applied to the tonsils they present an appearance of a diphtheritic mem-

(9) Med. Record, Jan. 6, 1912.

brane. Care should also be exercised to see that the tonsils have not been removed two or three days previous to the examination. Many a case of post-tonsillectomy has been mistaken for diphtheritic membrane. Cases sometimes show what looks very much like a pharyngeal or laryngeal membrane, but on close examination it proves to be an ulcer of some kind, tuberculous, cancerous, or syphilitic. Mistakes of this nature can be avoided, however, by a careful history and examination.

4. Retraction of Epigastrium: In children laryngeal diphtheria is a very common type of the disease. It is always wise, therefore, to observe the manner of breathing to see whether there is any retraction of the epigastric region. If retraction is present the case may safely be diagnosed as one of laryngeal diphtheria, and anti-toxin should be administered immediately. Very often a laryngeal diphtheria is mistaken for pneumonia, and the patient dies as a result of failure to intubate.

5. Nasal Discharge: All nasal discharges in children should be suspected as due to diphtheria. Many a case of nasal diphtheria has been taken for a "cold" till it was too late to do anything. It is therefore advisable to take a culture from every nasal discharge to be sure that it is not diphtheritic in character.

6. Acute Dilatation of the Heart: A goodly number of cases of post-diphtheritic myocarditis can be prevented if the patient is kept in bed at least two weeks after the temperature returns to normal. It is necessary to remember that the diphtheria toxin produces a degeneration of the heart muscle, and that it takes a long time for the heart to return to its normal condition, and consequently any strain put on it will produce an acute dilatation of the heart. When acute dilatation of the heart occurs the patient should be put to bed immediately and digitalis in some form or other should be administered. If this treatment does not cause the heart to return to its normal condition the physician may start the use of strychnine.

7. Bronchopneumonia: Bronchopneumonia is another complication that can be prevented in a great majority of cases. The air of the room should be kept warm, but at the same time it should be well ventilated.

If the room is also kept perfectly free from dust there is small risk of bronchopneumonia. If, however, the complication has taken hold, strychnine in doses of 1/200 of a grain every four hours should be administered to a child two to three years of age. If the child is not intubated syrup of ipecac in 10-minim doses can be given with beneficial results. If the child is intubated, the action of the ipecac may possibly make it cough out the tube.

8. Glands: In the winter many diphtheria patients develop suppurating glands. Levinson knows no method of prevention, but when such a condition develops the glands should be lanced to prevent a general septicemia by absorption of the organisms in the blood.

9. Discharge from the Ear: The ears of all diphtheria patients should be kept perfectly clean, otherwise a discharge, either diphtheritic or from a mixed infection, is likely to develop. In such a case the ear should be cleaned with boric solution and carbol-glycerin should be applied. If treated in this manner early in the stages of the infection, the discharge will clear up.

10. Post-diphtheritic Paralysis: If sufficient antitoxin is given early in the disease no paralysis will develop. When not given early enough paralysis of the recurrent laryngeal or even of the pneumogastric nerve is very likely to develop. Electricity and massage may be tried in a case of paralysis, but nothing seems to be able to cure the case once paralysis has set in. The better plan is to prevent the onset by giving sufficient antitoxin at the proper time.

TONSILLITIS.

Streptococcus Infection. The *Journal of the American Medical Association*¹ refers to an epidemic of streptococcic angina which occurred in Christiania in 1908 and was traced to the milk supply. In most cases the infection terminated by crisis after two or three days, but exceptionally there developed severe complications such as pyemia, acute nephritis, abscesses, otitis, and several deaths occurred. The bacteriologic examination revealed

(1) Feb. 3, 1912.

what seemed to be the same streptococcus in all the cases examined, but no minute study of the streptococcus seems to have been made so that it is not possible to say whether it could have been differentiated from other streptococcic strains or not. In May, 1911, a similar epidemic occurred in Boston and its vicinity. The cases were concentrated in families and the distribution coincided exactly with that of one of the two main milk supplies of the Deerfoot Company. At least 1,043 cases occurred in Boston and 48 deaths are attributed to the epidemic.

Symptomatically the disease corresponds with the septic sore throat of the English, many small epidemics of which, connected with the milk supply, have been described in England. Early there is a diffuse redness of the tonsils and adjacent regions and later follicular changes may develop. Swelling of the cervical glands and abscesses occur and diverse complications such as nephritis, pneumonia, pericarditis, or general streptococcic infection may occur.

The Journal draws the following lessons from these outbreaks:

1. Epidemics of streptococcus infection, localizing in the throat especially, may be due to contaminated milk-supply.

2. Streptococcus throat infection—"septic sore throat"—must be recognized as one of the dangers connected with the supply of raw milk even when this is most carefully supervised.

3. As pointed out by Winslow, the only real safeguard against such otherwise unpreventable outbreaks would seem to lie in pasteurization, carried out preferably by the holding system and in the final packages.

D. J. Davis and E. C. Rosenow² report an epidemic of sore throat due to a peculiar streptococcus. This epidemic occurred in Chicago during the winter of 1912. The attack usually began suddenly with or without a chill. The fever, the muscular pains, the prostration and the constitutional symptoms were out of all proportion to what one would expect from the amount of local involvement. The pulse was relatively slow. The

(2) Jour. Amer. Med. Assoc., Mar. 16, 1912.

leukocytes were only moderately increased. The throat presented a diffuse redness; there was much secretion of mucus. The tonsils were always infected and the crypts filled with an exudate; and a grayish membrane might spread over a large part of the tonsil (closely resembling diphtheria); only occasionally did ulceration take place. The acute symptoms often subside in a few days. At the end of a week or ten days, however, the patient, instead of recovering completely, may suddenly become worse. The cervical glands may become very large, but usually do not suppurate, or the neck may become tender and the act of swallowing very painful; and the clinical picture suggests septicemia. Blood cultures are almost always negative where glandular involvement is pronounced, while at the outset in the latter group of cases they yield streptococci. The visceral complications occur most often in the group of cases which have little or no glandular involvement, but marked constitutional disturbances. Otitis media occurs quite frequently, but suppurative processes in the mastoid and other accessory sinuses are relatively uncommon.

Bacteriologic examination showed the presence of Gram-positive cocci surrounded by a definite capsule occurring in short chains often in pairs. The organisms possess a high degree of virulence, readily killing guinea-pigs, mice and rabbits in from twelve to twenty-four hours from septicemia and serositis following intraperitoneal inoculation of small quantities. Animal passage increases strikingly the capsular substance, and the growth becomes more profuse and mucoid.

Necropsies have been made in 4 cases of this infection. In all there was acute serofibrinous peritonitis, in the exudate of which pure cultures of this streptococcus were obtained. In three, there was acute fibrinous pleurisy, in one acute pericarditis, and in three the cocci occurred pure in the heart's blood. Endocarditis was not found. The atrium of infection in 3 cases was clearly the tonsils or the throat. In the remaining case, it appeared to be a localized fibrino-purulent bronchitis following a sore throat.

To summarize, these infections are characterized by a sudden onset with severe prostration, by glandular en-

largement, and frequently by serious complications. The organism, isolated, is an encapsulated hemolytic streptococcus of high virulence. It appears to occupy a position between the ordinary hemolytic streptococcus and the *Streptococcus mucosus*. It is not a pneumococcus. The increase of the capsular substance on animal passage and its loss on artificial media suggest that the capsule and high virulence are the result of frequent human passage and may serve to explain the unusual tendency to complications and the general severity of the disease.

Pneumococcus Infection. L. K. Hirshberg³ reports an epidemic of tonsillitis in Baltimore complicated by adenitis, peritonitis and septicemia. The most striking clinical picture in this epidemic was the sharp onset, with the invasion always in the throat, general adenitis, great virulence, fulminant type of death in forty-eight hours in the lethal cases, the impossibility of proving milk, water or food responsible in the spread of the epidemic, and the constant presence of the pneumococcus as a possible causative organism. The author found an encapsulated coccus occurring in pairs and short chains and colored brownish black in a capsule stained pink, and fatal to mice in twenty-four hours. He considers it proved that this was the pneumococcus and not the *Streptococcus mucosus*.

Metastatic Orchitis. I. H. Prouty⁴ reports a case of tonsillitis followed by orchitis which recovered rapidly under the administration of hexamethylenamin.

RAT-BITE FEVER.

Infection from Rat-Bite. J. O'Carroll⁵ reports a case of relapsing fever due to a rat-bite. The patient, a single man, 36 years old, previously healthy, was bitten on the lip. When admitted the lower lip was hugely swollen, glossy, and purple, the chin was edematous and erythematous; the submaxillary and sublingual glands were enlarged and tender. This condition abated within a fortnight, and no organic fault was found anywhere. The urine was examined regularly, and no albumin or

(3) Jour. Amer. Med. Assoc., Apr. 20, 1912.

(4) Jour. Amer. Med. Assoc., Apr. 20, 1912.

(5) Dublin Med. Jour., January, 1912.

casts were detected during his stay in hospital, although he had irregular fever. Before leaving the hospital nothing abnormal could be found. The temperature was high and the patient was anemic, and complained of headache. He soon after developed parenchymatous nephritis for which he again entered a hospital under the author's care. Several attempts were made to cultivate organisms from the blood and secretions, but without result.

Towards the latter part of August the patient looked like an ordinary case of chronic parenchymatous nephritis. He was dropsical, subject to paroxysms of dyspnea, and very weak. Examination revealed the presence of fluid in the pleural cavities, and this was drawn off on three occasions with great relief to the dyspnea. From that time onward he steadily improved; the albumin in the urine fell to 1 gram per 1,000, the casts gradually disappeared, and about November 1st he was able to be up for a few hours daily. By the 1st of December, when he was allowed to go to relatives in England, he had recovered a fair share of strength; casts had disappeared from the urine, which showed only the very faintest trace of albumen with nitric acid. Two months later he was able to return to laborious duties, necessitating both office work and considerable exertion in outdoor inspection work.

In the *Quarterly Journal of Medicine* for January, 1910, T. J. Horder describes three cases of rat-bite fever, of one of which he had charge himself, a second under the care of Sir Almroth Wright, and a third of which he had been sent an account. All three recovered. All three cases showed the long course and the relapsing fever which have characterized the author's case, and in two of the cases submitted to the most careful bacteriologic examination no organism was detected. In Horder's own case there was a trace of albumin in the urine; in the other cases no urinary abnormality is recorded. The case now recorded appears to have exceeded in its pyrexial duration all the cases recorded by Horder; and in its association with what were, to all intents and purposes, the signs of an extremely serious nephritis it completely transcends them in gravity.

To-day—almost a year after his discharge from hospital—the patient remains in good health.

DISEASES OF THE MOUTH AND ESOPHAGUS.

Gonorrheal Stomatitis. E. D. Talbot⁶ reports that he has had two patients, both traveling salesmen, with gonorrheal infection of the mouth. He quotes W. L. Baum as follows:

“Gonorrheal ulcero-membranous stomatitis, is, according to Menard, always due to profound systemic infection and is always a secondary state. This position was opposed by J. P. Tuttle more than a decade ago, who cited in opposition, among other cases that of C. W. Culter, in which, in an adult, osculation of a gonorrheic penis was followed in a few hours by a raw, dry feeling in the mouth and in twenty-four hours by the lip vesicles. The gums by the third day were painfully swollen, and on the fifth day the mouth was intensely inflamed. A whitish fluid with a disagreeable odor and taste was secreted. The lips cracked and were covered with herpes; the lip and cheek mucous membrane was thickened, reddened, denuded of epithelium in spots, and in patches covered with a false membrane. Cases later reported by R. Larson were of similar type and origin.

“Gonorrhea, a common epidemic in institutions for children, usually assumes the form of ophthalmia, vulvovaginitis and pyemia. In a number of cases of infant pyemia reported by R. B. Kimball, no local lesion was found to explain the entrance of the gonococcus into the general circulation. In Kimball's opinion, the gonococcus may produce a stomatitis, from which a systemic infection could arise. Many conditions of the gums and alveolar process, such as occur prior to pyorrhea alveolaris, predispose to stomatitis, readily forming a culture medium for the gonococcus. Conditions like this in an infant can easily be mistaken for sprue and treated therefor, thus conceding a possible source of systemic infection resulting in pyemia.

“Gonorrheal stomatitis, in a case described by Juergens, developed on the gums and cheeks of a man*who

had recently had gonorrhea. The resultant dirty gray deposit contained the gonococcus."

Talbot expresses the view that the gonotoxin can be drawn to the alveolar process when the elimination is interfered with elsewhere. The alveolar process being a doubly transitory structure and an end-organ with poor vitality is acted on very quickly and destructively by these germs. The absorption of the tissues is so rapid that the teeth soon loosen and drop out if the disease is not arrested. In the author's own cases he believes that the infection resulted from the fingers as an intermediary host of the gonococcus.

Interstitial Gingivitis. E. S. Talbot⁷ does not regard the ordinary interstitial gingivitis sometimes called pyorrhea alveolaris as an infectious disease. That there are a few patients with infection of the gums all will admit, but these infections can easily be differentiated from the ordinary interstitial gingivitis so common in practice. The author's researches have shown that interstitial gingivitis is due to an irritation of both local and constitutional nature. These experiments have been made by every conceivable method on human beings and animals. He admits that when pyorrhea is present pus infection has taken place, but only about 10 per cent. of patients are so infected. This condition, however, is always secondary to the primary disease. From this point of view the opsonic and vaccine methods of treatment do not seem to be indicated. The local use of iodine and the sulphocarbolates by the operator and a stiff brush by the patient, with proper care of the general system, will cure all interstitial gingivitis and pyorrhea patients if undertaken before the teeth become loose.

Oral Infections. According to T. L. Gilmer⁸ the diseased mouth affords great opportunity as a gathering place and incubating center for pathogenic bacteria. Few mouths are free from lesions of some sort. Granulating pockets in the gums about teeth, from mechanical causes or from pyorrhea alveolaris, contain at all times a great flora of various species of bacteria. From these foci of infection opportunity is afforded for the passage of micro-organisms to other parts where they may be

(7) Jour. Amer. Med. Assoc., Feb. 10, 1912.

(8) Jour. Amer. Med. Assoc., Dec. 30, 1911.

instrumental in the production of various lesions. Chronic alveolar abscess is very prevalent. Some of the bacterial poisons from these infections are absorbed and under favorable conditions cause toxemias. Micro-organisms from alveolar abscesses at times gain access to the blood and lymph-streams, and when carried to a weakened heart, lung or kidney may be productive of serious lesions.

Mouth-breathers admit to the mouth bacteria far in excess of the normal; therefore, in case of stenosis in the nasal fossæ greater opportunity is afforded for infection through the oral cavity. Tubercle bacilli are found in the mouths of non-tuberculous patients. Diseased pockets in the gums, jaws, and tonsils, permit easy passage to the cervical and submaxillary lymph-glands. Streptococci when disseminated from diseased mouths cause at times serious infections, such as Ludwig's angina. Pharyngitis and tonsillitis are natural results of oral infections. The bacteria of chronic alveolar abscess and the laws of immunity and susceptibility must be better known before we can positively determine the relation existing between alveolar abscess and the subtle phenomena which may be dependent on them.

Oral Sepsis. G. M. Niles⁹ discusses the influence of oral sepsis on digestive disorders. The number and variety of germs in the mouth is enormous and there is opportunity for absorption of them or their products. They may also be swallowed and provoke gastritis, especially when the stomach is not protected by the gastric juice. Probably the majority of digestive disturbances arising from oral sepsis are put in motion by fermentations set up in the stomach and intestines. Among the most important are the lactic and butyric acid fermentations, and, as the lactic acid micro-organism is invariably found in connection with tartar and pus pockets around the teeth, we see how impossible it is to cure a chronic fermentative gastritis or gastro-enteritis while re-enforcements from an unhealthy mouth constantly aggravate the trouble. With the hydrochloric acid absent or deficient, antiseptic medication amounts to but

(9) Amer. Jour. Med. Sciences, February, 1912.

little, so long as the patient is swallowing countless fresh germs with each meal.

In gastric atony, dilatation, or pyloric obstruction, with delayed evacuation of the stomach contents, oral sepsis produces its maximum evil influence. Especially is this observed in old cases of pyorrhea alveolaris, where the pyogenic organisms, after leaving their "pent-up Utica" in the mouth, find a larger sphere of activity in the stagnant pool always present in the stomach. This fermentation continues with unabated energy in the alkaline and neutral secretions of the intestines, giving rise to flatulence, painful peristalsis, diarrhea, and various other intestinal ills. Appropriate diet, lavage, and antiseptics can mitigate these conditions, but no material nor lasting improvement may be expected until the fountain head is purified.

Esophagoscopes. In the opinion of W. Lerche¹ the essential features of a practical working esophagoscope are the following:

1. Simplicity of construction.
2. Ease of introduction without an obturator.
3. The source of illumination must be as near to the object to be examined as possible and so arranged that when instruments are introduced into the tube the rays of light are not intercepted.
4. By some simple contrivance that can be easily operated the field of operation must be kept constantly dry in order to enable the surgeon to work rapidly, thus reducing the length of the sitting to a minimum.

In the instrument used by the author a section-tube is introduced along the wall of the larger tube and made movable so that it can be pushed to the very end of the instrument, and thus mucus and blood removed so that the lamps may not be soiled and the light interrupted. The suction-tube is pulled back under cover of the larger tube both while the esophagoscope is being introduced and whenever the instrument is pushed forward. The handle is made detachable in order that it may be changed according to the position in which the patient is examined. (See Fig. 3.) The instrument is always introduced with the outer surface of its lip toward the

(1) Jour. Amer. Med. Assoc., Mar. 2, 1912, Digitized by Google

epiglottis and anterior wall of the esophagus, in this way entering at its widest diameter into the most easily distensible diameter of the canal through which it is to pass.

The introduction of this instrument is easy. The operator stands in front of the patient, and, holding the illuminated esophagoscopic tube near the proximal end with the right hand, places the lip of the instrument on the back part of the patient's tongue pointing somewhat toward the patient's right. While the operator now looks through the instrument it is passed over the epiglottis and down to the inlet of the esophagus. On gentle

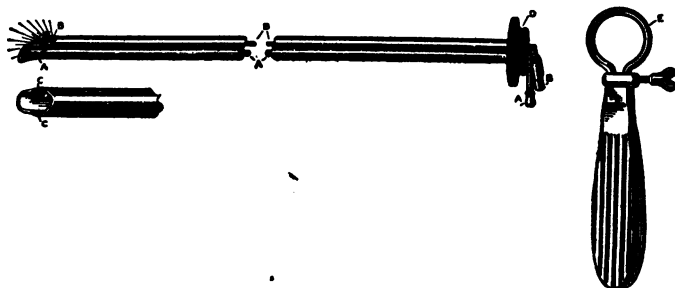


Fig. 3.—Esophagoscope. A indicates suction tube; B, light carrier, running in the groove C; E, detachable handle to fit in groove D.

pressure the cervical part is entered and the open thoracic part of the esophagus soon comes into view. (See Fig. 4.)

The principle on which all esophagoscopes have been constructed up to the present time has been seriously defective, as no attempt has been made to adapt the instrument to the anatomic conditions in the upper part of the alimentary tract. In the normal position, the oral cavity joins the upper esophagus at a right angle, and the only method hitherto in vogue to overcome this rectangular junction has been to extend the head forcibly and thus to approximate a straight line from the teeth to the cardia. This feature applies both to the simple straight tube and to the jointed instrument, and is the explanation of the unpopularity of esophagoscopy.

R. Lewisohn² has constructed an instrument which remedies this difficulty. It is built on a rectangular

plan similar to the gastroscope models of Poirier and Eckstein, although it differs from theirs in one essential particular. While theirs is a jointed one his is a telescope formed by six small tubes which fit into one another. Each tube is 5 cm. long and the diameter varies from 9 to 14 mm. The image is transferred at the rectangular junction by a mirror, while another perforated mirror in the eye-piece is used for the purposes of light reflection.

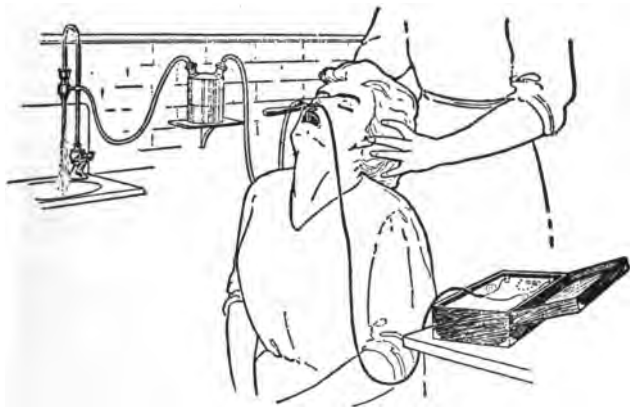


Fig. 4.—Patient in correct position with the esophagoscope introduced and the suction pump at work.

The instrument is introduced with the telescope closed. (See Fig. 5.) Then, by means of a spring, under guidance of the eye, the telescopic tubes are separated and pushed down into the esophagus. As no pressure is made on the tubes until they lie in the axis of the esophagus, the danger of injuring the posterior wall of the organ, which is present in all other methods, is entirely obviated. Lewisohn has used this esophagoscope in a considerable number of cases, but it has not yet been sufficiently tested in pathologic cases to show conclusive results as to its merit.

Autodigestion of Esophagus. W. Kernig³ reports a case of autodigestion of the esophagus in a woman

(2) Jour. Amer. Med. Assoc., Nov. 18, 1911.

(3) St. Petersburg Med. Zeitschr. Jan. 14, 1912.

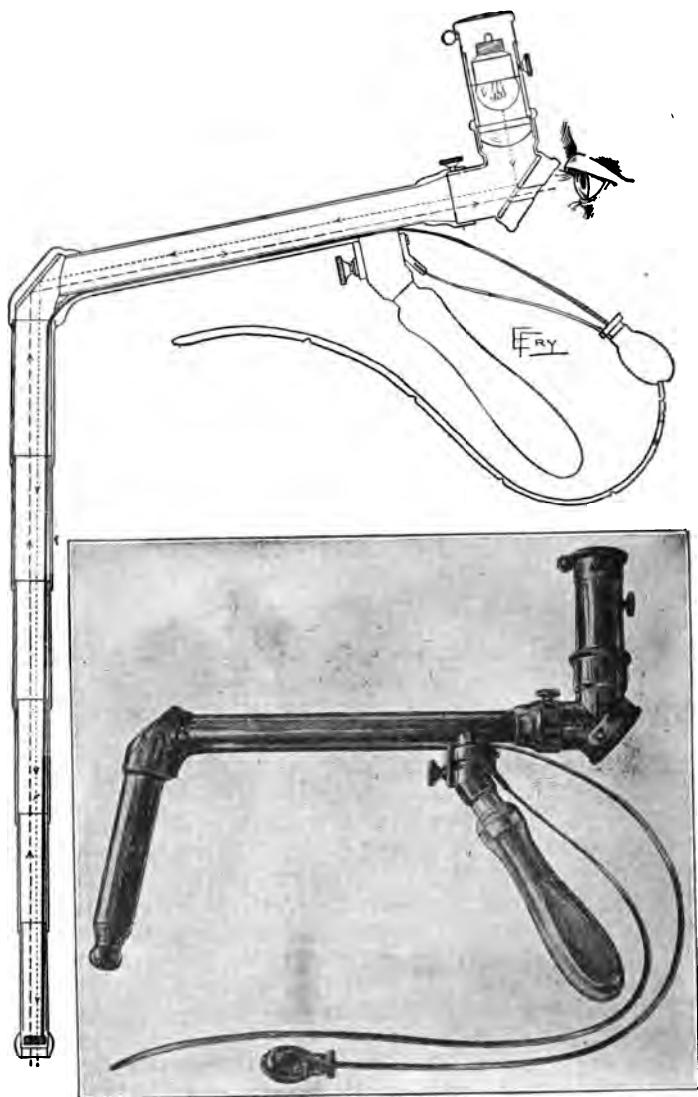


Fig. 5.—Diagram of esophagoscope, showing tube extended and general view of esophagoscope with the telescoping closed.

dying from fever post abortum. The patient was found by the author moribund with a patch of excoriation on the chin, and the abdomen distended with air. Poisoning with suicidal intent was suspected but the necropsy findings demonstrated that the peritonitis, originating in the genital organs, had induced repeated vomiting and the woman was too weak to expel the vomit, some of which remained in the lower part of the esophagus, and under its corrosive action the walls softened and ruptured, permitting the escape of air into the abdomen.

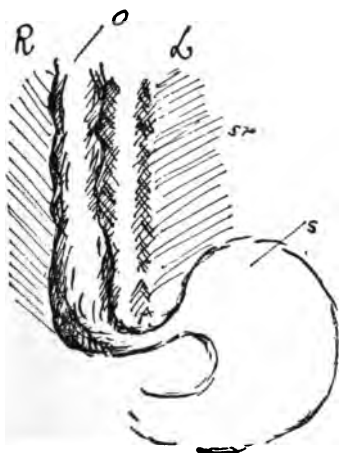


Fig. 6.—Diagram of post mortem appearance of stomach and esophagus. O, Esophagus; SP, spine; S, stomach.

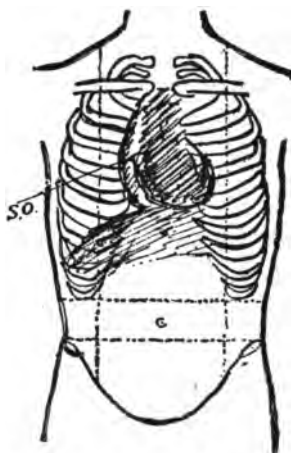


Fig. 7.—Diagram of x-ray photograph after a bismuth meal, SD, shadow of dilated esophagus; H, heart.

The vomit lying on the skin of the chin had induced a similar excoriation.

Dilatation of Esophagus. P. S. Hichens⁴ reports a peculiar case of esophageal dilatation in an achondroplastic dwarf. The esophagus was to the right of the spine, greatly dilated and obscurely sacculated in its whole length. (See Fig. 6.) The muscular walls were greatly thickened and also the mucous membrane, which, however, was quite smooth and not congested. The

(4) Brit. Med. Jour., Feb. 17, 1911.

walls of the esophagus were considerably thicker than the walls of the stomach.

To gain the stomach the esophagus crossed the spine at a right angle, as in the accompanying sketch. (See Fig. 7.) The mucous membrane of the esophagus showed no sign of ulceration, new growth, or any stricture. The cardiac opening of the stomach admitted the middle finger of the hand. Fluid poured into the esophagus seemed to pass with difficulty into the stomach.

What was the origin of this curious condition seems to be doubtful. If the position of the esophagus on the right side of the spine was a congenital anomaly, then probably the whole condition may be explained by the fact that the esophagus had to cross the spine at a right angle to gain the stomach. Food would tend to accumulate at the kink, and hence sagging and kinking would occur with the final result of a relatively complete obstruction.

The case might conceivably, however, have been one of the more ordinary cases of idiopathic dilatation of the esophagus, due possibly either to cardiospasm or paralysis of the longitudinal muscle of the esophagus. It is, perhaps, not impossible that under such circumstances the esophagus should finally get displaced across the spine owing to the increasing weight of food within it. The mature age at which the patient died seems to be rather in favor of the second theory, as it seems unlikely that such a serious congenital malformation as the first theory would involve would have permitted the patient to reach adult life.

DISEASES OF THE STOMACH AND DUODENUM.

PHYSIOLOGY.

Tonus and Motility of the Gastro-Intestinal Canal.

W. B. Cannon⁵ emphasizes the importance of tonus for the movements of the alimentary canal, and shows that the movements of the colon start from a ring of tonic contraction near the cecum. A ring at the cecum repeatedly sends off downward-running waves. A new

(5) *Archiv. Int. Med.*, Oct. 15, 1911.

ring made now near the terminus of these waves starts reversed waves; and a tonic ring made midway in the proximal colon not infrequently will originate waves which pass away in both directions. Mechanical stretching is well recognized as a most efficient stimulant for exciting activity in smooth muscle. Since smooth muscle surrounds hollow organs which gradually fill and must be emptied, the value of distention as a stimulus is obvious. When an organ with walls of smooth muscle is flaccid and toneless, distention calls forth no response.

The author has repeatedly attempted to call forth rhythmic contractions both in the atonic stomach and in the atonic colon by distention but without success. The precise relation between the degree of tonus and the internal pressure that results in rhythmic contractions is difficult to define. When a tonic ring is first made in the colon it is a deep and strong contraction, and it manifests no evidence of pulsations. Only when it has to some extent relaxed does it begin to beat rhythmically. On the other hand, if the internal pressure is sufficiently increased, the waves moving along the intestine will disappear and can be seen again only when the distention is reduced. Both the tonus and the distending force, therefore, can be too great for rhythmic action. The author concludes that the tonus of the stomach is excited through the vagus by psychic influences in the same way as psychic secretion. He concludes as follows:

Looking back over the evidence here adduced we see that double provision is made for the establishment of a state of tonic contraction in the alimentary neuromusculature. Almost the entire length of the digestive canal is supplied with extrinsic nerves which when stimulated cause an increase of tone and when destroyed leave the canal at first in a toneless state.

And if the canal is entirely separated from the central nervous system it has a remarkable power of developing an independent tonic state. When thus isolated, the canal regains its characteristic movements only as it recovers tone. Tonus is therefore fundamental. It supplies the resiliency that causes the state of tension when the canal is filled, or establishes the state of tension

when the canal is only partly filled. The state of tension is the occasion for the contraction of viscera which are walled with smooth muscle holding a nerve net. Refractoriness to stimulation during contraction, and gradually increasing irritability during relaxation, result in a rhythmic response to the condition of tension. The most characteristic feature of the movements of the alimentary canal, their rhythmicity, can thus be accounted for.

The view that tonicity of the neuromusculature of the alimentary canal is a fundamental necessity for the appearance of rhythmic movements harmonizes many diverse observations. It accounts for the failure of efficient motility in atonic states of the stomach and intestines. It gives a reasonable explanation for the existence and importance of extrinsic motor nerves. It is in agreement with the observation that tonic contraction and rhythmic peristalsis disappear together in cases of general bodily weakness, when the depleted central nervous system may be supposed to fail to deliver the necessary tonic impulses; it is also in agreement with the observation that worry, anxiety and distress stop gastro-intestinal movements, for such states, accompanied by splanchnic impulses, abolish tonus. It fits admirably with the fact that the stomach of hungry animals is strongly contracted, for then the tonic state makes the organ ready for instant action on swallowed food. Indeed Cannon is inclined to believe that the sensation of hunger results from the tonic contraction of an empty stomach. These are only some of the conditions in which the importance of tonus for movements of the alimentary canal is manifested; doubtless other conditions will suggest themselves.

Complex Phenomena of Various Types of Unobstructed Gastric Peristalsis. L. G. Cole⁶ draws the following conclusions from observations made by means of radiograms taken of successive phases of a single peristaltic cycle:—

1. The gastric motor phenomenon is complex rather than simple, as evidenced by a systole and diastole of

(6) *Archiv. of Röntgen Ray*, December, 1911.

the stomach, in addition to the peristaltic contractions passing toward the pylorus.

2. The stomach goes through a series of motions best described as a gastric cycle.

3. Peristaltic contractions progress toward the pylorus, requiring as many cycles as there are contractions visible. A single or individual peristaltic contraction should not be confused with a gastric cycle.

4. Three or four peristaltic contractions in the stomach at the same time are more frequent than one or two.

5. When food is in contact with the cardiac end of the stomach, contractions begin near the fundus, and frequently are as deep in this region as near the pylorus.

6. They show why considerable confusion has arisen from previous contributions toward the solution of this question, which were apparently contradictory.

Regurgitation of Food. A. Bernheim⁷ reports that a patient, a young physician, regurgitates food voluntarily and intentionally, whenever he desires to relieve symptoms of gastric distress. He usually takes a glass of water, to liquefy the contents of his stomach, so that they may come up easily; and also takes some bicarbonate of soda, so that the acidity of the regurgitated material may not injure the mucous membrane of the throat and mouth. He then bends over, so that the abdominal muscles compress the stomach. The esophageal opening of the stomach then dilates, and the food comes out.

Temperature of the Stomach. The effect on the temperature of the stomach produced by various hydrotherapeutic applications has been investigated by Eichner and Schaemel⁸ who used for the purpose of measuring the temperature a special apparatus for the registering of fever made by Siemens and Halske. The behavior of the various applications was determined and charted. A hot douche showed a prompt rise of temperature. The local arc light produced less effect and the immediate rise of temperature was relatively greater. The stomach appliance of Winternitz gave somewhat remarkable results, in that the temperature rose very slightly at first and then fell somewhat slowly to a point

(7) Boston Med. and Surg. Jour., June 1, 1911.

(8) Deutsche med. Wochenschr., Dec. 21, 1911.

below its original temperature. A warm compress led to an actual and somewhat marked diminution of the temperature. The same was indicated by the results of the icebag, but in a more marked degree. The authors hold that their investigations have confirmed the results of other authors to the effect that heat causes an increasing temperature and cold a fall of temperature in the parts of the body, in the organs situated beneath the application. The investigation of the effect of such applications on the secretory activity of the stomach showed that there was an uncertain influence on the acidity, but the amount of mucus was reduced, the motility became better, and the subjective symptoms were either greatly reduced or disappeared altogether.

Molecular Concentration of Stomach Contents. M. Loeper and J. Think⁹ discuss the molecular concentration of the gastric contents and conclude as follows:—The study of the molecular concentration of the gastric juice shows the importance of physical phenomena in the physiologic state in originating secretion and no doubt also in effecting the opening the pyloric sphincter. It also shows the hyperconcentration in cases of stasis and retention, and its influence on retention, on hypersecretion and perhaps on spasm of the pylorus. It permits us to appreciate the great rapidity of dilution by some mucous membranes and extreme slowness of dilution by others. To be sure it gives no certain indication as to the nature of a lesion but it does permit us to judge with regard to the circulatory condition of the mucosa and its permeability, which seems greater in ulcers and hyperesthesias than in normal individuals and less in cancers, gastric atrophies and achylas.

Such a study is interesting not simply from a theoretic point of view. It also permits some deductions in therapeutics, especially in dietetics. It shows that concentrated substances should be prohibited or used with care in cases of hypersecretion as they cause too rapid dilatation and distend the stomach to a painful degree, causing the expulsion of its contents. Also in those affected with hyposecretion concentrated substances may involve too much labor to bring about the required de-

(9) Archives des Mal. de l'App. Digest., March, 1912.

gree of dilution, thus retarding notably the beginning of chemical secretion. In cases of pyloric spasm they retard the evacuation of the stomach contents into the duodenum, and may lead to an overconcentration of the stomach contents with fatal results.

DIAGNOSIS.

Functional Examination of the Stomach. The value of the symptoms and physical findings in comparison with the results of functional examination of the stomach is well illustrated in an article by A. Galambos¹ who undertook an investigation of these points in a series of 86 patients. As a result of the examination of the stomach contents he classified his cases as follows: Hyperchlorhydria, 27; normal acidity, 20; hypochlorhydria, 21; achlorhydria, 18. A more elaborate statement of the diagnosis is given, but as the author remarks, it is in some ways unsatisfactory and is therefore, omitted.

Careful records of the symptoms and clinical history showed that the cases presented no pathognomonic symptoms and that more or less characteristic symptoms are found only in isolated cases. Heart-burn is not to be regarded as a characteristic symptom of hyperchlorhydria since it also occurs with hypochlorhydria and achlorhydria. The same is also true for acid eructations. Heart-burn and acid eructations occur quite often in combination, but each is found by itself alone in certain cases. There are, moreover, cases suffering from achylia gastrica which exhibit the typical pains of hyperchlorhydria. On the other hand, heart-burn and acid eructation are lacking in about half the cases of hyperchlorhydria. Patients with hyperchlorhydria feel the pain usually after eating. The heart-burn of patients suffering from hypochlorhydria often appears before eating and is somewhat relieved or ceases entirely after eating. At other times it appears independently of the taking of food, and even on an empty stomach.

A feeling of pressure in the stomach, most frequently after eating, is as characteristic of anacidity as heart-burn of hyperacidity. This feeling is relatively rare in

(1) Archiv f. Verdauungskr., Bd. 17, H. 4.

gastritis. Nausea and a tendency to vomit usually precede the vomiting but they frequently exist for a long time without causing vomiting. Vomiting is in general more frequent in cases of hyperchlorhydria than in those of hypochlorhydria or achlorhydria. Pain and cramps in the stomach are not characteristic. The author found pain frequent in gastritis but in no case were the pains of a colicky character. Loss of appetite has no pathognomonic value and the same is true of emaciation. A bad taste in the mouth is usually felt in the early morning and sometimes is a constant symptom. The author found it most frequently in cases of catarrh of the stomach, but on the other hand it was lacking in hypochlorhydria. Vertigo is a symptom occurring in all forms of gastric disease, most frequently on an empty stomach, but often enough after eating or independently of food. Constipation is disproportionately more frequent in hyperchlorhydria than in achlorhydria. On the other hand, diarrhea was entirely lacking in hyper- and hypochlorhydria but was frequent in anacidity and especially in achylia gastrica. It was more rare in gastritis. Despite the uncertainty of many symptoms the previous history is not to be underrated.

Physical Signs. The author lays little stress on the examination of the tongue, because many healthy people may have a coated tongue, and on the other hand patients with serious disease of the stomach may present a tongue that is pale or bright red. The occurrence of impressions of the teeth on the tongue is to be regarded as the result of glossitis. [It would seem that these impressions might easily arise from an enlargement of the tongue due to relaxation of the blood-vessels without active inflammation.—S.] The significance of tremor of the tongue is analogous to that of the finger or the eyelids.

The author lays little stress on the occurrence of the splashing sound as he concludes with Koranyi that the splashing sound may be elicited not only in atonic but also in normal stomachs. However, he says that the superficial splashing sound is as a rule but not always, a sign of atony. The splashing sound can, however, be used as a means of diagnosis of motor insufficiency if it

is found at a time when the stomach should be already empty.

By physical examination of the stomach the presence of a thickened hypertrophic gastric wall can be recognized by inspection and partly with the help of palpation; principally at the time when the stomach begins to drive its contents through a narrowed pylorus, when also a squirting sound is audible and the sensation palpable over the rigid stomach.

In his examinations Galambos found the loose tenth rib not specially frequent. More frequently the tenth rib was less firmly attached than usual. He says: "The common occurrence of nervous asthenia, nervous dyspepsia, atony of the stomach, nephroptosis, fluctuating tenth rib, etc., demonstrates without doubt the common character of these diseases. The theory advocated by Stiller of neurasthenic diseases taken as a whole I regard as acceptable but in many cases it not only leaves us in the lurch but may even lead to erroneous conclusions. There are patients with atony, dyspepsia, and neurasthenia with a fixed tenth rib and there are still more individuals with a free or loosely attached tenth rib without asthenia, and finally there are diseases of the stomach in which the tenth rib is, to be sure, more loosely attached than normal, but the stomach symptoms are not to be referred to a simple asthenia but arise from another, perhaps somatic, disease of the stomach. On the other hand, even with a fixed tenth rib the possibility of pains depending on atony must be kept in mind. As a result we are compelled to regard the claim of Stiller that the free tenth rib with certainty indicates a nephroptosis and atony of the stomach as somewhat exaggerated."

Functional Examination. Galambos employed an Ewald-Boas test-breakfast and removed the stomach contents at the end of three-quarters of an hour. Galambos discusses the appearance and consistency of the stomach contents as well as its odor and the well-known characteristics of well-digested and undigested contents. Considering the various ingredients he regards mucus as a normal constituent of stomach contents, but only in slight amount as it is for the most part digested by pepsin and hydrochloric acid. In pathologic conditions the

amount of mucus increases. Whether the mucus is secreted by the gastric mucous membrane or originates from the esophagus or the trachea is commonly easily determined. In the latter case the mucus is not mixed with the stomach contents but is either compact or foamy. The mucus secreted by the gastric mucous membrane is commonly in larger amount, evenly distributed and intimately mixed with the particles of the roll. The simplest way to convince oneself of the presence of mucus is to try to draw out a part of the stomach contents with a glass rod. In normal conditions we find little or no mucus whereas in the case of genuine catarrh of the stomach smaller or larger masses of mucus always adhere to the glass rod. Stomach contents containing mucus are very difficult to filter. Galambos depended on the concurring results of macroscopic and microscopic examination and found that of his 86 cases, 12 showed a primary catarrh of the stomach.

In considering the presence of blood in the stomach contents the question whether it has originated from an injury by the tube or is due to occult bleeding becomes very important. This can be determined according to the author, by microscopic examination. He gives the following distinction: If the bleeding was caused by the stomach-tube the numerical relation of the red and white blood corpuscles is the same as in the blood, while on the other hand, in case of an occult bleeding (from carcinoma, ulcer, erosion) the white blood corpuscles, in consequence of the more or less marked inflammation accompanying these conditions, are disproportionately increased. Often the border of the opening in the stomach-tube brings away a little piece of the gastric mucous membrane, in which case smaller or larger pieces of mucous membrane stained with blood may be present in the stomach contents. In such cases red blood cells are commonly found if a macroscopically recognizable hemorrhage is not present, neither in the liquid part of the stomach contents nor in the pieces of the roll, so that if pieces of tissue are present and the bleeding is only microscopically recognizable the red blood cells are to be regarded not as the result of the mechanical injury but as coming from an erosion or an ulcer, and the

pieces of tissue may be parts of the mucosa which come from the neighborhood of the erosion or ulcer.

These pieces of tissue are not rarely found in the stomach contents. Galambos found them in 6 cases of which one was certainly a case of carcinoma of the stomach. In a case of achylia gastrica he made a functional examination twice and in each case found pieces of tissue in the stomach contents. In a case of anacidity he also found the same conditions twice, and moreover there was in both cases a colony-like increase of the Oppler-Boas bacillus. The last case was one of hyperacidity and continuous gastrosuccorrea. The appearance of these pieces of tissue is not characteristic of carcinoma nor applicable as a means of differential diagnosis between achylia and carcinoma. In fact, several authors regard them as especially characteristic of achylia.

Galambos lays great stress on the *microscopic* examination of the stomach contents. He finds that the division of bacteria into short and long is not entirely correct, because many transition-forms are observed. The greatest interest attaches to the long non-motile bacilli, the so-called lactic acid bacilli of Oppler-Boas. These which were first thought to be characteristic of carcinoma are now known to occur in all forms of stomach disease, most markedly in anacidity, especially when combined with motor insufficiency; but the author also found them at times in hyperacidity in such numbers as to dominate the field under observation. The precaution of Sahli should be taken to wash the stomach thoroughly before a diagnostic significance should be attributed to the finding of these organisms. Their persistence in carcinoma in these conditions is probably due to the fact that they cling to the irregular surface of the carcinomatous mass, while if the wall of the stomach is smooth they are easily washed away. Galambos warns against being content with the examination of a single field under the microscope. Often bacilli will be found in one field which will be absent in another from the same contents. Galambos examines at least four preparations. His findings in regard to yeast and sarcinae correspond with the usual experience. He calls attention to the fact that a diagnosis of achylia can be made from the appearance of

the starch granules which have been so completely digested that they have lost their contour and characteristic markings, appearing as granules stained blue with iodine in a mass of débris consisting largely of coagulated plant albumin.

Nervous dyspepsia formed the most frequent finding in the cases investigated by the author. He discusses the various conceptions of nervous dyspepsia, particularly the view of Leube, that it is a primary affection of the stomach and the contrary opinion of Ewald, that it develops secondarily to a previous neurasthenia. Somewhat different is the view of Pawlow that the psychic disturbance and the disturbance of the gastro-intestinal canal are to be regarded as primary and opposed to each other. According to the author's view nervous dyspepsia is a disease that occurs as a part of a general neurasthenia. It may be for a long time the only symptom of the constitutional affection and may be followed by symptoms of neurasthenia in other organs. But in such a case it is not to be assumed that the nervous dyspepsia leads to the general nervousness, but that the nervous dyspepsia as a symptom-complex of the already existing constitutional affection transforms the latent neurasthenia into an active one.

A more important consideration is that nervous dyspepsia may not only exist as a part of a general neurasthenia but it may be combined with an organic disease of the stomach. The stomach affected by organic disease becomes a *locus minoris resistentiae*. In this way incongruous symptoms not characteristic of the organic disease may be presented, and thus the clinical picture be completely obscured. In this way cases of ulcer, carcinoma, etc., sometimes present no distinct symptoms. Again it is possible that the organic affection of the stomach, by leading to malnutrition, may create a neurasthenia which may have as a part of its symptom-complex a nervous dyspepsia which completely disappears with the cure of the basic organic disease.

Aside from the simultaneous presence of organic and functional diseases of the stomach there may occur in the same individual functional affections of different kinds. As has been shown typical symptoms are not

found in any disease of the stomach. The cause of this circumstance is to be sought partly in the fact that the dyspeptic symptoms of the patient do not coincide with the functional changes, but they depend much more on a sensory anomaly, quite independently of the anomaly of secretion, as is shown by the cases of achylia gastrica and hyperacidity which run a symptomless and painless course. It is possible that a patient who complains of constant heart-burn and in whom examination shows anacidity, becomes anacid through the irritation caused by the examination, and it is also possible that aside from the disturbance of secretion there is a sensory change quite independent of it.

Galambos calls attention to the various causes which may account for the insufficient motility observed in many cases of nervous dyspepsia. It may be due entirely to a nervous cause, or a slight organic affection of the stomach muscle may coexist, or again such conditions as ptosis or the kinking of the pylorus or a natural or acquired weakness of the musculature may play a part. Constipation often leads to a disturbance of the motility; it is not impossible that the hyperacidity so frequently found in connection with constipation depends on the prolonged stay of the food in the stomach and that this circumstance also explains the frequent hypersecretion. Finally the author believes that this delayed motility, especially in the slighter forms of atony, may depend on a deficient sensitiveness or anesthesia.

In achylia gastrica there is usually assumed to be an increased motility, a hyperkinesis. Galambos, however, frequently observed a hypokinesis. The cause of the apparent hyperkinesis is often the coarse, poorly digested stomach contents which stopped up the opening of the stomach-tube. The author's observations make it quite probable that there exists an alkaline or amphoteric hypersecretion. He reports one case showing this in a marked degree. In the differential diagnosis between carcinoma and achylia too much reliance should not be placed on hyperkinesis in achylia.

Sudden changes in the secretion findings were noted in 2 cases. In one the findings varied between hypochlorhydria and normal conditions; in the second there

were found in succession hypochlorhydria, anacidity, and then hyperacidity. Heterochylia is more frequent than is generally supposed, but it requires repeated examinations in the same individual to bring it out. In nervous dyspepsia the same conditions or nearly the same are found on repeated examinations, but we may designate heterochylia as a hysteria of the gastric secretion. A constancy of relationship between the stimulus and the resulting reaction may be held to characterize neurasthenia, while sudden and irregular changes indicate hysteria.

As a result of these investigations Galambos considers it as demonstrated that while the clinical history and the physical examination afford valuable data, the functional examination is necessary to determine a correct diagnosis. Aside from evident contra-indications the use of the stomach-tube should not be neglected in any cases of gastric disease.

Gastroscope. A gastroscope described by E. J. Moure² consists of an outer tube, the lower half of which is flexible, the upper straight and stiff, which is first introduced into the stomach, guided by a mandarin which is afterward withdrawn. This is followed by the introduction of a straight, rigid inner tube which contains a small electric lamp, a prism and an eyepiece. The tube is first introduced with the patient sitting, the throat being cocaineized. The patient is then made to lie on the table on the left or right side according to the side of the stomach which it is desired to inspect. The head is held by an assistant. The stomach is emptied and the rigid inner tube is introduced. (See Figs. 8, 9, 10 and 11.) The duration of the examination is from a few minutes up to 20 or 40. It takes some time to become accustomed to the appearance of the mucosa so as to see clearly. Different parts of the stomach can be brought into view by moving or rotating the tube. The stomach is inflated by a bulb and a tube running by the side of the gastroscope. The gastroscope should, of course, be thoroughly sterilized, although from the nature of the operation absolute asepsis is impossible to maintain. In

over 30 examinations which he has made with his instrument, Moure has not had an accident.

Moure has had constructed of rubber a phantom stomach with a window in the wall by which practice with the gastroscope can be gained and the movements of the instrument inside the stomach can be controlled by the eye until the necessary facility is attained. The region near the cardia cannot be exposed except by means of a reversing prism which Moure has had no occasion to use and hence cannot give his experience with. (See Fig. 11.)



Fig. 8.—The patient is placed in the right or left lateral position and the head bent strongly backward. The operator introduces the rigid conducting tube with its mandrin. An assistant holds the head.

After describing his results the author concludes as follows: Although well convinced that gastroscopy is destined to render to physicians important services by permitting one to make at the beginning a diagnosis of neoplastic lesions which may, perhaps, be cured by surgery, and although it appears much superior to exploratory laparotomy which it may advantageously replace,

it is none the less true that this method of examination if it is to be an aid in the clinic will demand severe practice and the regular training of the operator and also of the patient to be examined. It is not necessary to be discouraged because one experiences some failures at first. With gentleness and patience and a little good-will one will easily conquer the difficulties of the beginner and master a method of examination which must enter into ordinary practice to the same extent as cystoscopy, bronchoscopy, esophagoscopy, which are already almost ordinary methods of endoscopy.



Fig. 9.—The conducting tube having entered the stomach the operator removes the flexible mandrin. The liquid contents of the stomach can flow out freely.

Determination of Motility. *Leube's Test-Meal.* I. Boas³ emphasizes the value of the Leube test-meal and does not place in high esteem the modification introduced by Kemp which consists in the addition of stewed plums and cranberry sauce. He calls attention to the fact that if the stomach was empty seven hours after a Leube test-meal there can be no serious motor insufficiency. On the other hand, if remnants of food are found after that time it is not always possible to affirm positively the existence of motor insufficiency. Such a condition may be occasioned by inhibitory influences from the duodenal or

(3) Deutsche med. Wochenschr., Mar. 7, 1912.

pylorus reflexes occasioned by abnormal formation of acid or by hypersecretion. However, so far as his own experience goes he does not regard this objection as of special importance. As a rule one may conclude that if larger remnants of food are found in the stomach seven hours after the test-meal that a motor insufficiency of greater or less extent is present.



Fig. 10.—The periscope has been introduced through the conducting tube. A second assistant is inflating the stomach and watching the degree of tension of the epigastric region. The operator is examining the gastric mucosa through the periscope.

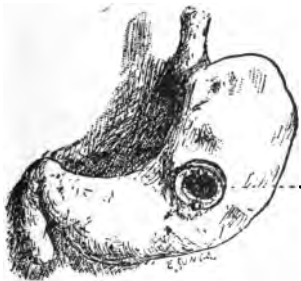


Fig. 11.—Phantom stomach. The central opening may be closed at will with an opaque or transparent closure so as to enable the observer to control with the eye the position and movements of the instrument. This rubber stomach has an esophagus attached so that one can imitate the introduction of the gastroscope. The interior of the cavity of the stomach is covered with drawings of the various lesions of the mucous membrane.

He notes some disadvantages of the Riegel test-meal. An abundant meal of this sort is difficult to administer to individuals with no appetite, but the appetite exercises an important influence not only on the secretion but also on the motility. There is a motility which is under the influence of psychic conditions similar to the psychic secretion. In other cases like ulcer and carcinoma the test-meal is not so protective as we must require it to be; and finally the result of a later applied lavage, which in itself is not very pleasant, gives only approximate values in the estimation of the degree of motor insufficiency, values which in later comparison permit a judgment as to improvement or the lack of it under the influence of therapy to be made only with caution. Even the exact quantitative measurement of the test-meal, if it is even practicable, complicates the procedure to a certain degree. In view of these objections Boas advocates a method depending on the amount of liquid expelled from the stomach in a given time. This method possesses the following advantages:

1. The water that is drunk stimulates the secretion of the gastric juice at most to a slight extent, and provokes no reflex action of the pylorus.

2. The liquid remaining can be regained without difficulty.

3. A stratification or sedimentation is of no consequence.

4. As large amounts of liquid pass the pylorus within a short time one can even under pathologic conditions estimate the motility of the stomach in a short time.

Riegel's Test-Dinner. A. Borgbyärg⁴ discusses the question of the motility of the stomach and the propriety of the Riegel test-dinner as a means of determining the motility. He concludes as follows:—A careful determination of the motor function of the stomach is still more important than the investigation of the relations of the secretion. The examination is best made by means of the Bourget's method as modified by Faber. The Bourget-Faber test-meal consists of 250 c.c. of oat-meal porridge, 50 grams of boiled and hashed meat, 50 grams of white bread with butter, 8 stewed plums and

a tablespoonful of cranberry sauce. The terms 5, 6, 8, and 12-hour retention are used when one finds in the stomach at least 10 c.c. of food remnants 5, 6, 8, or 12 hours after a Bourget-Faber test-meal. The 12-hour or continuous retention depends as a rule on an organic stenosis of the pylorus, but can also be produced by a spastic stenosis (as in ulcer) and occasionally by gall-stones. The 5 and 6-hour retention occur most frequently in organic diseases of the stomach (carcinoma, ulcer, gastritis), but also occasionally in dyspepsia with or without hypersecretion in cases in which no positive signs of an organic disease of the stomach are present, and occasionally also in purely intestinal diseases. They are also found, partly in congenital asthenia, (frequently in cases of gastropptosis), and partly in asthenia as a result of inanition.

In cases in which no continuous retention can be demonstrated there is found in some instances a small 12-hour retention, that is, 12 hours after the Bourget-Faber test-meal one finds in the morning before breakfast on washing the stomach some small remnants of food in the stomach (cranberry seeds, small pieces of plum, occasionally meat fibers), altogether at most 2 to 5 c.c. This small retention is as a rule the sign of an organic disease of the stomach (carcinoma, ulcer or gastritis, particularly gastritis with achylia).

If constipation is associated with 5 or 6-hour retention an anticonstipation diet rich in cellulose is contra-indicated. A protective diet often secures a cure of the motor weakness of the stomach and intestines. In poorly nourished patients the deficiency of motility is often removed by a rest cure.

Test-Meals. Benton and Tidy⁵ studied 331 test-meals of toast and tea at the London Hospital. In cases of gastric carcinoma Günsberg's reagent gave a negative test and the total acidity was highest when the lesion was at the pyloric end. With a low acidity, it was either in the cardia or in the body of the stomach and inoperable. Taken in connection with the length of history given by the patient, the gastric analysis is of some

(5) Quart. Jour. Med. Sciences, 1911, p. 449; Abs. in Amer. Jour. Med. Sciences, November, 1911.

importance. A patient with carcinoma and a gastric history of less than two years almost certainly has no free HCl in the test-meal. One with a gastric history of more than four years and no free HCl almost certainly has no carcinoma. In the rare cases of carcinoma grafted on an old ulcer there was generally presence of free HCl and the total acidity was normal or above. Thus, the picture resembles the ulcer type. In the cases of ulcer it was observed that marked anemia may lead to a diminution of the free HCl. Especially is this the case after severe hemorrhage. And it is noteworthy that free hemorrhage may lead to an amelioration of the symptoms. Dyspeptic cases with low acidity early lost their symptoms on the administration of acids. This furnished a good clinical differentiation from carcinoma, where the acidity is usually unchanged and the symptoms unmodified. In dealing with free acidity they found Günsberg's reagent of much greater importance than the dimethylamidoazobenzol. The methods generally in use are approximately accurate when the free acidity is normal or above normal, and not so accurate when it is below, while the phosphates which are secreted into the stomach when the mucous membrane fails to elaborate HCl, detract from the accuracy of ordinary methods. This inaccuracy is common to all methods. Therefore, the simple Günsberg reaction and estimation of dimethyl acidity and total acidity by phenolphthalein are quite sufficient.

Comparison of Wet and Dry Test-Meals. A. F. Chase⁶ has compared the gastric contents removed after a dry test-meal consisting simply of a roll and a wet test-meal consisting of a roll and 400 c.c. of water. These were given to 47 patients on alternate mornings for a series of days and the quantity of gastric contents, total acidity and the amount of free hydrochloric acid were determined with the following results:

1. Comparatively slight differences in the volume expressed and in the acidities obtained were noted in the results between the dry and wet test-breakfasts, suggesting a correlation existing between motility and secretion—a tendency to automatic regulation of the

(6) Jour. Amer. Med. Assoc., July 1, 1911.

gastric function. The variation between wet and dry tests is, however, greater than between wet and wet tests, and between dry and dry tests.

2. The dilution of the juice by water is greater than the stimulating effect of water on the peptic glands.

3. The volume obtained after a wet test-breakfast is practically always greater than after a dry test-breakfast. No definite relationship could be made out between the volume and the acidity.

4. In proportion of two to one, the acidities obtained after a dry test-meal are greater than those obtained after a wet test, the exact figures being as follows: In 33 cases the results after a dry test were greater than after a wet test, and in 14 cases after a wet test-meal the results obtained were greater than those after a dry test.

5. In all cases of pyloric stenosis the results obtained after a wet test-meal have been greater than those obtained after a dry test-breakfast.

6. In myasthenia gastrica in which there is delayed motility, the results regarding the acidity obtained after a dry test-meal have been usually greater than those obtained after a wet test-breakfast, because in the case of the wet test, water remains in the stomach to dilute the juice.

7. In cases of disordered motility, the dry test-meal is a more accurate index of the secretory function of the stomach than the wet.

The part which fatigue plays in the rate with which the stomach empties itself has, with the assistance of the fluoroscope, already been taken up, but the material so far has not allowed of any conclusions. It is, however, a line of investigation which appears very promising, particularly in view of the new fundamental discoveries regarding tonicity presented by Cannon.

A New Test-Meal. D. Roberts⁷ has devised a test-meal on the same principle as that of Sahli's butyrimetric test-meal, using as the test-substance lactose instead of fat. In detail the test-meal is made as follows:—To 300 c.c. of freshly made weak tea 30 gm. of lactose are added. This fills two ordinary tea-cups. It has been

(7) Jour. Amer. Med. Assoc., Mar. 16, 1912, digitized by Google

found of practical advantage to give at the same time one pilot biscuit or two soda biscuits. Crackers containing salt, sugar or dextrin should not be used. After this test-meal has remained in the patient's stomach for an hour a liberal portion is extracted, and, preferably with the bulb, water, about 200 c.c., but necessarily a definite amount, is forced into the stomach through the tube. The mixing in the stomach is effected by partly withdrawing the contents and forcing them back again several times before the extraction of the second sample. These two samples are then ready for analysis. The free acidity of the first is determined and has been found to be comparable to the free acidity resulting from the Ewald test-breakfast. The total acidity of both specimens is then estimated with great care, using phenolphthalein as an indicator. The residue, after the extraction of the first portion, is determined by means of the Mathieu formula as follows: Let A equal the acidity of the first portion, and B the acidity of the second portion; then $B \times 200 \div (A - B) = X$, i. e., the residue. To find the total stomach contents after the lapse of one hour it is necessary, of course, to add the quantity of the first specimen to the residue as found by the above formula.

The next step is the determination of lactose in the first specimen. Before satisfactory results were obtained many methods of lactose determination were experimented with until, finally, trials were made with the method of Gerard and Allen as modified by Rüdich and Cellar. This modification of Fehling's solution is made by adding one part by volume of the mixed copper and Rochelle salt solution to four parts by volume of 50 per cent. aqueous solution of chemically pure potassium sulphocyanate. Twenty-five c.c. of this solution, the equivalent of 5 c.c. of mixed Fehling's solution, are gently boiled in a porcelain dish, and the sugar solution is added drop by drop, preferably from a burette. The end-reaction is a quick and sharp loss of color, and when the experiment is done with care many trials with the same specimen give results which show less than 0.1 per cent. variation. In determining the lactose percentage in this solution, the end-reaction has been found even

more sharp than is the case with a complex fluid such as urine. The presence of acids in the stomach contents has not seemed to alter the results in any way.

It must be remembered in making these estimations that the oxidation of copper by lactose is somewhat slower than with glucose, and care must be exercised to add the drops slowly and to titrate during the dropping. It is more convenient to work with filtered chyme that has been diluted three or four times. The number of cubic centimeters of the undiluted chyme necessary to decolorize 50 c.c. of the Rüdisch-Cellar solution having been found, to find the percentage of lactose it is necessary to divide, not 0.05 gm., as is the case for glucose, but 0.06 gm., as lactose has a different power of reduction. Reduced to simple terms it may be said that six divided by the number of cubic centimeters of undiluted chyme necessary to decolorize 50 c.c. of the Rüdisch-Cellar solution gives the percentage of lactose.

Having previously determined the stomach contents at the end of one hour by the Mathieu formula, it is now determined just what portion of this is test-meal and what portion gastric secretion. If 30 gm. of lactose were given to the patient the amount of fluid test-meal remaining would be proportionate to the amount of lactose remaining. The actual amount of lactose is easily determined by multiplying the determined total residue by the determined percentage. Let L equal the number of grams of lactose in the stomach contents, and A the number of cubic centimeters of contents; then the following formula needs no explanation: $300 : A :: 30 : L$, 300 being the amount of fluid test-meal ingested. Simplified, this formula will read $10 \times L = X$. The amount of gastric juice in the stomach contents is found by subtracting the discovered test-meal residue from the total residue found by Mathieu's formula.

Source of Error in Gastric Analysis. C. S. Fischer⁸ emphasizes the fallacious deduction liable to be drawn from ordinary gastric analyses on account of the imperfect homogeneity in the gastric contents. Imperfect homogeneity is a physiologic condition and is proportionate to the consistence of the food. The greater the

(8) N. Y. Med. Jour., May 6, 1911.

consistence the less homogeneity exists. As a result of this the material withdrawn by the tube from different depths in the stomach may give very different results as to the degree of acidity or as to the specific gravity. He has shown this by observations of the results obtained by a simple method of dual extraction which he has employed for the last two years.

The test-meal employed was a simple one, composed of a cup of tea, one slice of dry bread, and a quarter of a pound of lean, chopped beef. The extractions were made two and one-half hours afterward by separate individuals. The first extraction was made by passing a very flexible tube to a point just beyond the cardia where, by aspiration, the first contents appeared. Only a small quantity was taken for analysis. The second extraction by another examiner was made immediately following by passing a more rigid tube well into the cavity of the stomach, a distance of from four to six inches beyond the point attained by the first tube. Here, also, only a small quantity, sufficient for analysis, was extracted. The manipulations employed differed in no manner, either as to care or exactness, from the usual routine procedures in common practice, the only precaution being the selection of cases sufficiently tolerant to admit of examination without violent restlessness or retching. The following are the results obtained in a dozen cases of various diagnoses:

	Free hydrochloric.	Total acidity.
1. Superficial	45	75
Deep	20	75
2. Superficial	32	60
Deep	42	60
3. Superficial	54	75
Deep	44	80
4. Superficial	8	48
Deep	8	48
5. Superficial	30	70
Deep	40	80
6. Superficial	25	75
Deep	20	75
7. Superficial	25	70

	Free hydrochloric.	Total acidity.
Deep	15	75
8. Superficial	40	85
Deep	55	105
9. Superficial	25	70
Deep	20	70
10. Superficial	38	94
Deep	28	92
11. Superficial	60	108
Deep	50	120
12. Superficial	10	40
Deep	0	35

It will be noted that the greatest difference exists for the free acid. This may vary from 0 to 25 points, and is most pronounced in cases of excessive acidity. The total acidity shows very little variation.

From these experiments it would appear that too great reliance cannot be placed upon casual gastric analysis. Two examiners may obtain entirely different results, dependent upon the consistence of the test, the time of examination, the depth of extraction, the rigidity of the tube, and, most important of all, the muscular activity of the organ.

Determination of the Amount of Stomach Contents.

A. Laboulais and R. Goiffon⁹ review the subject of the method of determining the quantity of stomach contents devised by Mathieu-Remond, and describe a new method by which the fallacies of the Mathieu-Remond method are obviated. Their conclusions are as follows:

1. Stomach contents after a test-meal are not uniform. The composition of the liquid removed by the tube varies according to the time at which it is extracted (beginning, middle, end).

2. Each method which is intended for the determination of the quantity of stomach contents by the quantitative determination of one of its constituents, that is by its estimation in a sample of the undiluted liquid extract and in the residual liquid which has been diluted with a definite amount of distilled water, gives inaccurate results.

3. This difficulty may be avoided by a modification of the Mathieu-Remond method.

Principle: A definite quantity of a solution of a known titer (best sodium phosphate) is mixed with the residue of the gastric juice to be estimated. From the new titer of the solution one can determine the volume which is sought for by a very simple formula.

Technic: After extracting a definite amount of stomach contents there remains in the stomach a volume of liquid designated by v . To this there is added by the tube a measured amount (q) of a solution of sodium phosphate with a known titer (n). After sufficient mixing a sample is removed of which the new titer (n') is determined. According to the equations:

$$nq = n'(v - q)$$

$$v = \frac{nq - n'q}{n'}$$

the amount of the residual fluid and also the entire volume of the contents present in the stomach before the removal of the first sample can be determined.

The removal of the first sample is, moreover, not unconditionally necessary, especially if the stomach contains only a small amount of secretion. On the other hand, for this purpose one may immediately remove from the stomach a sufficient amount of stomach contents so as not to operate with too large an amount of fluid in the process of dilution. This method possesses the following advantages:

1. It is always exact, however small the volume of stomach contents, and whatever may be the composition of the gastric juice.

2. It is not actually necessary first to obtain a sample of stomach contents; therefore, this method is specially suited for cases with a small quantity of stomach contents in the morning as well as in cases of mild stasis. It permits by means of the quantitative values obtained in the diluted gastric juice the determination of the exact value of the pure gastric juice.

3. Its application is convenient and quickly executed. A result can be reached in a quarter of an hour.

Examination of Vomit. In discussing routine examinations of the gastro-intestinal tract T. W. Stumm¹

(1) Journal-Lancet, Jan. 15, 1912.

describes as follows the examination of vomited matter :— Much information may be gained by examination of the vomitus. The gross appearance may show us the presence of food and considerable about the progress of digestion. If pieces of meat are seen seven hours after ingestion one can readily conclude that the digestion of proteids is poor. The digestion of bread in the stomach is less, though if particles are seen but little changed this is recognized as pathologic, for the normal appearance of bread after it has been in the stomach for some hours shows it to be in a finely divided state.

The time that the emesis occurs after ingestion is of great importance. If immediately after eating, one is inclined to look for some cause other than the stomach itself; while if particles of food can be recognized that were taken the day previously stagnation is assured, and usually this is due to pyloric obstruction. Accurate analysis of the vomited contents is usually not necessary, though one can easily test for free HCl, and the odor will frequently give information as to the presence or absence of organic acids. There may be much mucus that is apparent. Blood in a somewhat altered state is not uncommon in amounts varying from just enough to be recognized to an appalling amount; small red streaks have no significance. Bile is frequently seen, though is not present as often as one might judge from the descriptions given by patients. Pus may be present, though this is not a common finding.

Fecal vomiting is of significance when it occurs and should never fail to receive grave consideration. The odor and color should be enough to cause recognition in this condition, but it is sometimes overlooked. Now and then large amounts, a quart or more, of thin watery material is vomited, frequently or at rare intervals. Simply dipping in a strip of congo paper will tell whether free HCl is present or not; usually in such instances it is. Uremics frequently vomit, and the odor here is often characteristic, the smell being more or less like ammonia, this being due to the decomposition of urea that has occurred in the stomach. Intestinal parasites are occasionally brought up from the stomach. Associated with any or all of these conditions one not un-

commonly notices a greenish color. This is due to a bacterial growth that has been demonstrated, especially in stagnating contents.

Bile in Stomach Contents. H. W. Goodall² gives the following method for detecting bile in the stomach contents based on the oxidization of bilirubin with nitric acid, forming green biliverdin:—Half a test-tube of the fluid portion of the stomach contents is taken. If this amount cannot be obtained, or if the contents consist largely of solid material, it should be diluted with water, thoroughly mixed, and the fluid portion poured off or filtered. The fluid is then saturated by shaking one or two minutes with ammonium sulphate crystals, or, better, crystals which have been ground into a fine powder. About an inch in the bottom of the test-tube is usually sufficient. Then from 1 to 3 c.c. of acetone (about a quarter of an inch in the test-tube) is added, and the whole thoroughly mixed by inverting the test-tube five or six times. It is best not to shake. After standing a minute or two the acetone rises to the surface of the fluid, carrying bile pigment up with it. A drop of yellow nitric acid is allowed to run down the side of the test-tube and the green reaction occurs in the acetone layer. Care should be taken in adding the acid, as too large quantities produce too rapid an oxidization, and the green quickly passes over into a purple or reddish color. If the acetone does not promptly rise to the surface the liquid has not been thoroughly saturated with ammonium sulphate. If too much acetone is added, the bile may be diluted to such a degree that the reaction is not distinct. This procedure is delicate enough to demonstrate bile in contents which macroscopically do not suggest its presence.

It is not sufficiently emphasized that in stomach contents, especially vomitus, containing large quantities of bile which has already become oxidized to a deep-green color, the direct application of bile tests fail to demonstrate the true nature of the pigment. The above procedure can be applied to such stomach contents after diluting four or five drops of the contents with half a test-tube of water. The delicacy of the test under these

(2) Boston Med. and Surg. Jour., Mar. 28, 1912. Google

conditions depends on rendering the bile sufficiently dilute.

Determination of Acidity. E. Schlesinger³ advances a new method for the determination of the total amount of acid in the stomach contents by means of the *x*-ray. The method depends on the principle that when a carbonate is given to a patient whose stomach is acid, the evolution of gas, (carbon dioxid) increases the collection of gas in the fundus of the stomach. The details of the method are as follows: The patient receives on an empty stomach in proportion to his height 300 to 400 gm. of freshly prepared bismuth corn-meal gruel, or a gruel which is prepared from 75 to 125 gm. of zirconium oxid, 25 gm. of corn meal (mondamin), and 250 gm. of water, with a small addition of saccharin and vanillin, after which the form, position and size and other peculiarities of the stomach are determined, and at the same time it is determined how much increase occurs in the accumulation of air in the stomach. The investigation is then suspended and an hour later a picture is taken at the height of inspiration. The patient then receives a solution of sodium bicarbonate, 3 gm. in 40 c.c. of water, which he is told to drink with the strict injunction under no circumstances to belch. Two minutes later a second picture is taken at the same phase of respiration; the second picture shows the main point of the investigation,—the marked increase in the space occupied by air. The difference between this space in the two pictures shows the amount of carbonic acid gas that has been liberated from the soda, and forms a basis for the estimation of the acidity of the stomach contents. The greater the amount of carbon dioxid collected, the higher is the acidity. By this method of investigation it is possible to determine the amount of the gastric juice or of the total stomach contents, and to determine with approximate accuracy the amount of carbon dioxid set free and hence the total amount of acid in the stomach. From these two factors it is possible to conclude how great the relative acidity of the stomach contents is.

The method is of special value for such cases of disease

(3) Deutsche med. Wochenschr., July 27, 1911.

of the stomach as are unsuitable for the removal of stomach contents by the tube, and the author hopes that when some difficulties have been removed it will be possible to secure accurate results.

Test for Occult Blood. *Phenolphthalin Test.* Phenolphthalin is a derivative by reduction of phenolphthalein, and in alkaline solution is readily changed by oxidizing agents to phenolphthalein which gives a red color to the liquid. It is applied on account of this property to testing for blood. Boas makes use of a modification of Meyer's reagent. This consists of 1 gm. of phenolphthalein, 25 gm. of fused potassium hydroxid and 100 c.c. of water to which 10 gm. of powdered zinc is added. The mixture is boiled over a small flame with shaking until it is decolorized, then filtered hot, and to the filtrate zinc powder is added in excess, to prevent a gradual oxidation of the reduced solution. The reagent is applied to an ethereal extract of the feces obtained in the usual manner for the application of Weber's test. A few c.c. of the stool are stirred with water to a thin liquid and shaken in a test-tube with 1 c.c. of glacial acetic acid, after which 10 c.c. of ether are added. The contents are carefully mixed a number of times and the ether separated from five to ten minutes later. If there is a large amount of blood present the addition of the ether extract to the reagent produces a spontaneous red coloration. If the extract contains little blood or only traces of it, the red coloring does not appear until a few drops of a solution of hydrogen peroxid have been added. If no reaction occurs it is desirable for the sake of control to add a few drops of sodium or potassium hydroxid solution in order to ensure an alkaline reaction. Practically this is of little importance if only a small amount of the acetic acid ether extract is added.

R. Goldschmidt⁴ has investigated the reliability of this test and concludes that his observations confirm in most important points the results of Boas. He believes that on account of its sharp indications, its reliability and the convenience of application, the phenolphthalin

(4) Deutsche med. Wochenschr., July 20, 1911.

test is a welcome addition to the resources of the practitioner.

Benzidin Test. F. W. White⁵ reports his further results with the benzidin test for occult blood which he uses in the form of Schlesinger and Holtz modification. This modification reduces the delicacy of the original Adler benzidin test by using a small amount (2 to 3 drops) of the material for examination, and excludes oxidizing ferments as a source of error by boiling. The technic is as follows:

The material for examination consists of simple gastric contents, or of a pea-sized piece of feces thoroughly stirred in a test-tube into about 4 c.c. of water. This is brought to boiling to destroy oxidizing ferments. Ten drops of a fresh solution of benzidin (prepared by shaking a knife-tip of benzidin in about 2 c.c. of glacial acetic acid) is added to 3 c.c. of a 3 per cent. (ordinary commercial solution) of hydrogen peroxid in a test-tube. This mixture serves as a control of the cleanliness of reagents and glassware.

To make the test, add 2 or 3 drops of the boiled gastric contents or of the mixture of feces to the peroxid-benzidin mixture. A clear green or blue color appears within a minute or two when blood is present. White has added the drops of material to be examined without shaking the mixture, in which case a deep ring of color develops only at the top. This gives a sharper result when little blood is present.

The method is simple and rapid and easily learned. It can be performed within five minutes. With pure reagents the results are uniform and reliable. The color changes are clear and sharp even in feces, because very little fecal pigment is present to interfere. The ether extraction of the guaiac test is replaced by the simple quick method of boiling.

The uniformly negative results in the 273 examinations of feces in the 217 non-ulcerative cases show that this modification of the benzidin test cannot be charged with being too delicate for clinical work. Misleading positive results are absent. In about one-fifth of the stomach contents in these cases a minute trace of blood

(5) Boston Med. and Surg. Jour., June 22, 1911.

results from the use of the tube. This is about equally true with the guaiac test and seems unavoidable.

Blood was found in *every examination* of the feces of healthy persons on a meat diet.

Blood was found in *all but two* cases of chronic peptic ulcer.

Blood was found in *every examination in every case of cancer* of the stomach or bowel examined. These are clearer, more uniform results than White has seen reported with the guaiac test, or has been able to get with it himself. The contrast between ulcerative and non-ulcerative cases is sharper. *In his opinion they show that the benzidin test has more value than any other blood test in detecting chronic ulceration in the digestive tract.*

Chronic peptic ulcers are characterized by intermittent bleeding, and about one-half of the specimens of feces and gastric contents examined in these cases were negative, but it is not surprising that some positive results were obtained in almost every case when we consider that the patients were almost without exception referred at a time when they were at their worst, when the ulcers were most irritated or inflamed and most likely to bleed.

The author has tried the phenolphthalin test but does not regard it as delicate as the benzidin. He makes the following remarks regarding the interpretation of blood tests:—"In conclusion, I do not wish to exaggerate the importance of blood examinations. Nothing could be worse than to jump at conclusions in a case from a few blood tests. I always look with the greatest care for all other signs and symptoms of ulceration. We all realize the difficulties of interpretation of results. We know that benign cases with blood in the stomach are not always ulcer, and that negative results do not always exclude chronic ulcer. We realize that there is an early stage in every cancer that is non-ulcerative, and that scirrhus cancer may ulcerate late.

"Piles and other rectal diseases are a great nuisance, at times preventing the use of blood tests in the feces, but in spite of all I find that blood tests are a very great help in clinical diagnosis, and I believe that the Schles-

inger and Holtz benzidin test is the best one to use, on account of its simplicity, clearness and degree of delicacy."

Spectroscopic Test. Csepai⁶ compares the relative accuracy of investigation of feces and gastric contents for blood. He finds that the most sensitive test is the benzidin, which depends on the catalytic action of benzidin and hydrogen peroxid. The old tests by crystallization of hematin have been abandoned because of their lack of sensitiveness. The catalysis tests are not as good as one could wish, because they react to plant chlorophyll and other bodies and because the reagent readily spoils. He recommends a spectroscopic test. The instrument used may be of the cheapest variety; 5 c.c. each of concentrated acetic acid, alcohol, and ether are rubbed up for a few minutes into about 5 grams of feces, then filtered through a dry paper. To this extract in a test-tube 1 to 2 c.c. of pyridin and 1 to 3 drops of ammonium sulphid are added. The resulting mixture in the presence of blood shows the spectrum of hemochromogen. The patient should, of course, be on a hemoglobin and chlorophyll-free diet for about three days before the test, i. e., he should have no meat or green vegetables. The test must be done immediately after the addition of the ammonium sulphid, for delay causes weakening of the absorption spectrum.

Effect of Prunes on the Benzidin Test. S. Florsheim⁷ has found that prunes will give a positive reaction for blood with the benzidin solution but are negative to aloin and guaiac. Immediately on floating the ethereal extract of the prunes on the ozonized benzidin solution a cloudy field having a distinct greenish tinge was produced. Florsheim concludes that the prunes contain a substance which reacts to benzidin; hence the use of prunes before making the test for occult blood should be avoided.

Sources of Error. E. C. van Leersum⁸ calls attention to the danger of the small bleeding produced by the use of the stomach-tube, especially in case of ex-

(6) Deutsche Archiv f. klin. Med., 1911, Vol. 103, p. 459; Abs. in Amer. Jour. Med. Sciences, November, 1911.

(7) N. Y. State Jour. Med., February, 1912.

(8) Münch. med. Wochenschr., Feb. 6, 1912.

foliating gastritis and catarrhal achylia, being mistaken for occult blood. In the case of exfoliating gastritis the mucosa is so fragile that even straining at stool may tear off scraps. When testing the stools for blood the patient should be warned from any movement that will produce strain of the stomach or abdomen. The eating of meat should be avoided and care should be taken that menstrual or hemorrhoidal blood shall not be mixed with the feces. This source of error can be obviated by washing the lumps in a 3 per cent. solution of hydrogen dioxide, after which the guaiac test is applied to a sample of stool from the center of the lump.

W. A. Newbold⁹ has observed a fallacy in Weber's test for blood in the feces which may sometimes be of importance. In a case which gave the reaction for blood without the presence of any blood cells he found that the substance which led to error was watermelon pulp. It then occurred to him that the coloring matter of the melon pulp might give the characteristic chemical test for blood, and an experiment proved this to be true. It was also found that the expressed juice of the melon gave a similar color reaction, but in the latter experiment the color did not prove to be so dark a blue as when the pulp of the melon was used.

The objection to drawing conclusions from the results of examination of the stomach contents obtained by means of the stomach-tube is a serious one and clinicians can not afford to give much weight to so misleading a test. This opinion is confirmed by the conclusions of H. W. Soper¹ reached after an examination of 200 cases of functional disease of the stomach for occult blood in the stomach contents after a test-meal. Of these patients 80 gave negative results and 120 positive. Soper concludes: "It seems clear that no conclusion can be drawn from an examination of the stomach contents for occult blood. Neither a positive nor a negative reaction can be relied on."

Differential Count of Leukocytes. J. P. Sawyer² reports that in practically all of his cases, for several years, a differential count of leukocytes had been made

(9) Jour. Amer. Med. Assoc., Nov. 4, 1911.

(1) Interstate Med. Jour.,

(2) Boston Med. and Surg. Jour., June 1, 1911.

under his own control; and in the course of these observations he has often found the differential count of clinical advantage. He did not refer in this clinical study to established departures from normal counts, as found in the known so-called blood diseases; he spoke more especially of the considerable variations from the usually accepted average differential counts in adults; for in children we have the known mononuclear lymphocyte counts in high proportion. The average lymphocyte count is about 30 per cent. A slight variation from this is not of considerable moment, but when the lymphocyte count rises to 40 or 50 per cent., this is probably indicative of a considerable departure from the usual blood formation. The lymphocytes are the product of the lymph tissues, discharged into the blood. Therefore, from a study of cases of high lymphocytosis, it is possible to gather information regarding possible stimulation of lymphatic tissue. These large lymphocyte counts are found without leukocytosis in a considerable number of diseases; among them, cases of gastro-intestinal disease. It occurs in cases in which gastro-intestinal catarrh is not discoverable by examination of the test-meal or of the stool, and in which the history shows no record of the existence of such catarrh recently. The condition of the gastric secretion seems to have no determining influence upon this lymphocytosis. It is usually found in persons whose resistance is low. In such cases it is possible by treatment of the patient to bring about a very prompt and decisive change in this lymphocytosis. This treatment consists in the administration of iodid of iron for a few weeks and the exhibition of arsenic. This treatment brings about a prompt reduction in the lymphocyte count, and the patients gain rapidly in weight and strength.

THERAPEUTICS.


Gastric Lavage. The importance of gastric lavage as a therapeutic agent has been at times over-rated, but of late its field has been much restricted on account of the recognition that it is capable, especially in the hands of the laity, of doing harm. Its principal indication is the removal of retained stomach contents,—contents that

have remained in the stomach over night. It is probable that in this reaction against excessive use some valuable indications have been lost sight of. At least this is the opinion of K. Strübe³ who gives the following estimate of the therapeutic value of lavage of the stomach. As a result of his experimental work he has applied lavage in a wider range of affections than heretofore.

The action of gastric lavage is due to several factors which sometimes co-operate to secure the therapeutic effect, while at others one or other mode of action becomes especially prominent. First of all the circulation of blood and lymph in the walls of the stomach is quickened, and the absorptive power of the stomach is increased. The digestion is improved with the increased secretion of the gastric juice, and there results an improvement in nutrition and bodily vigor. Secondly, the removal of the products of fermentation lessens the systemic intoxication and benefits all the organs and tissues of the body. In addition to this there is the thermic effect and the reflex action on which the increased flow of urine often observed may depend. Finally lavage is beneficial in a great variety of disturbances of the stomach and secondarily benefits the general system by removing the secondary effects of stomach disease. This therapeutic measure should therefore be applied in all cases in which the etiology indicates that one of the above methods of action will be effective.

Strübe suggests a trial of lavage in glycosuria, albuminuria of unknown origin, common acne, obstinate disturbances of the intestine with diarrhea or constipation, in neurasthenia, and certain psychic conditions of depression, bronchial asthma, neurosis of the heart, and certain affections of the bile-passages. All these affections may originate from dyspeptic disturbances without the dyspepsia being especially prominent. Gastric lavage acts most promptly and reveals in the shortest time the underlying affection, the treatment of which is of so much importance, thus permitting the cure of diseases that are often treated for months or years symptomatically without success.

A large percentage of cases of anemia in girls at

(3) Klin.-therap. Wochenschr., June 5, 1911. 

puberty is, in Strübe's opinion, the result of peptic insufficiency of the stomach, brought on by the diversion of blood from the digestive organs during menstruation. In such cases iron preparations are injurious. Occasional lavage, in addition to hydrochloric acid and pepsin, is of great advantage in such cases. Many cases of acute anemia from loss of blood in the author's experience recover more quickly under the influence of lavage than by means of any other medication. He records an instance in which a biliary calculus which had to be left in the common duct on account of the collapse of the patient at the operation, was expelled into the intestine after six washings of the stomach.

Influence of Medicaments on Motility. In a general review of the recent acquisitions regarding gastric motility F. X. Guraud and H. Paillard⁴ give the following facts regarding the action of medicaments on the movements of the stomach:—Carrier has studied with the aid of radioscopy the method in which various remedies intended to accelerate the contraction of the gastric muscle in cases of atony react. He administered a test-meal composed of 200 c.c. of bouillon, 60 gm. of meat, 50 gm. of bread, and 200 gm. of milk gruel, with the addition of 30 gm. of bismuth. In a normal individual from 4 to 5 hours are required for the whole of this meal to leave the stomach. He experimented with a series of medicaments which he classifies as follows in the order of the decreasing activity:

1. Strychnine and nux vomica.
2. Ipecac in doses of from 5 to 10 cgm. (1 to 2 gr.).
3. Ergot in doses of from 15 to 20 cgm. These three remedies are remarkably active.
4. Caffeine in doses of 25 cgm.
5. Amorphous quassin, 0.05 gm.; absinthe, 0.01 gm.; and hamamelis, 30 drops of the tincture.
6. Gentian, colombo and menyanthes, of which the action is insignificant.

We have learned that in a normal stomach it is sufficient to introduce some food which distends the walls to induce them to respond by a reflex contraction. Binet sought to explain by this mode of excitation the useful effects of waters containing bicarbonate, and of sodic bicarbonate in digestive affections. For a long time bi-

(4) *Prog. Méd.*, Aug. 19, 1911.

carbonates were supposed to have only a purely chemical rôle:—the saturation of an excess of hydrochloric acid by the soda contained in the salts; or on the other hand instead of the excitation of hydrochloric acid at the expense of the sodium chlorid of the blood there was a substitution of carbonic acid for the chlorin, a somewhat paradoxical change, but explicable according to the physiologists by the fact that the carbonic acid is set free in a nascent form and then becomes more active chemically. There is no doubt that bicarbonates play an important rôle in these reactions, but Binet remarks with justice that for the purpose of saturation of acid, magnesia or chalk possesses a much higher power, and yet does not have the same happy therapeutic results. In fact the bicarbonate of sodium acts not only on the chemism of the stomach but also on its motility. The carbonic acid gas set free distends the stomach and excites its contraction; moreover, it is a powerful anesthetic to the mucous membrane. It is, therefore, useful to relieve certain reflex spasms due to hyperesthesia of the mucosa which very frequently result in a contraction of the pylorus.

Binet has proved the influence of bicarbonate of sodium on the emptying of the stomach by making the same patient at intervals of several days take an Ewald test-breakfast preceded or followed by the administration of 3 gm. of bicarbonate of sodium, of prepared chalk, or of calcium magnesia. The stomach contents were removed one hour and a half after the ingestion of the meal and the total volume noted. In the cases in which the bicarbonate had been taken this volume was less than the total amount removed in the same condition in the same patient who had taken a simple Ewald test-breakfast. After the ingestion of chalk or magnesia the volume was equal or greater, whence he concludes that the bicarbonate exerts an excitomotor action.

Influence of Physical Measures on Motility. There is no doubt that physical measures form a powerful auxiliary for facilitating the evacuation of the stomach. Carrier has studied the influence on the motility of the stomach of certain agents which he classifies as follows in the order of their decreasing activity:—

1. Massage, performed three hours after the meal.
2. A Wattville current.
3. The faradic current, and

galvanic currents with rhythmic, slow interruption. 4. The application of cold compresses three hours after the meal. 5. The drinking of very hot drinks after the meal. 6. The limitation of the amount of fluids. 7. Prolonged mastication. 8. The application of hot compresses.

Influence of Hygienic Measures on Motility. Hygiene has naturally also a great influence on gastric motility. This has long been known but more and more use is being made of rest after meals in the horizontal position for dyspeptics, and this posture evidently acts especially by reducing the effort necessary for the muscle to drive the food through the pylorus. Some patients with dilated stomachs reach a point where they can no longer digest the food except in this position. Carnot has perfected the technic by insisting recently on the benefits of the right lateral decubitus, which facilitates still more the task of the pylorus. A. Markobich and F. Perussia have shown that 300 gm. of bismuth bouillon are evacuated in from $2\frac{1}{2}$ to $4\frac{1}{2}$ hours in the right lateral decubitus and in from 5 to 7 hours in the left lateral decubitus. This difference is still more marked in cases of atony of the stomach. It is less, on the other hand, if there is stenosis of the pylorus.

Along with this factor of the position of the stomach Jacquet and Debat have emphasized the importance of slow eating. By experiments based on radioscopy they have shown that a too rapid and imperfectly chewed meal imposes too intense and too prolonged distention on the stomach. The contrary is true when the meal is slowly taken and carefully masticated. Guraud and Paillard reach the following conclusions:

One suffers because the stomach empties itself insufficiently rather than because digestion is imperfect. Therapeutic measures which are addressed to the gastric motility are always beneficial, even if they are not always sufficient.

FUNCTIONAL DISEASES.

DIAGNOSIS.

Rarity of Gastralgia. L. Kuttner⁵ calls attention to the rarity of true gastralgia. Some direct or indirect,

(5) Therap. d. Gegenwart, February, 1912.

near or remote cause can almost always be discovered. Pain in the stomach is frequently the expression of disease in the lungs or pleura, heart, liver, etc. He cites a number of cases in which vomiting and other gastric symptoms were regarded and treated as a neurosis but were finally traced to a diverticulum in the esophagus or a kinking above the diaphragm, a chronic nephritis, meningitis, brain tumor or tabes. Recent examination of 100 patients with various nervous affections has shown that deviation of complement, lymphocytosis and the globulin reaction in the lumbar puncture fluid, even with no other symptoms on the part of the central nervous system, can be accepted as evidence of the central origin of the so-called periodic vomiting. In two recent cases the periodic vomiting occurred without headache, dizziness, syncope or tendency to apoplexy, and yet the trouble proved to be multiple sclerosis. Periodic vomiting with acetonemia, in children, is probably a manifestation of an inherited diathesis. Hyperchlorhydria may be the only manifestation of chronic appendicitis or gallstones, and he reports two cases of this kind, the treatment having been directed exclusively to the hyperchlorhydria, and the underlying affection having been neglected and allowed to progress to a dangerous point. Anorexia may be the only sign of tuberculosis, or a distaste for meat be the only sign of gastric cancer, while an exaggerated appetite may be a sign of pregnancy or diabetes, gastric or duodenal ulcer or some serious mental or nervous disease. All of these must be excluded before assuming a true sensory neurosis of the stomach. A test for alimentary glycosuria may help throw light in these cases. The so-called dyspeptic asthma can generally be traced to arteriosclerosis or some other affection of the heart or vessels.

Necessity of Excluding Organic Affections. J. Kaufman⁶ warns against diagnosticating a gastric neurosis because the patient happens to be a neurasthenic. A patient may present the appearance and the characteristic symptoms of neurasthenia or hysteria and at the same time harbor a gastric ulcer or carcinoma. A further factor which frequently proves misleading is the negative

result of examination. The absence of anatomic alterations in the stomach is merely an assumption which is usually based on the findings of gastric analysis. Our present methods of examining gastric contents do not always permit the drawing of a sharp line between functional disorders which are provoked only by the derangement of the nervous mechanism of the stomach and those which are associated with anatomic lesions. Hypersecretion when associated with gastric ulcer, may present identically the same gastric analysis as that found when this secretory disorder is of purely neurotic origin. One should not be satisfied that he is dealing with a neurosis until all methods of examination which might possibly furnish evidence of an organic disease have been exhausted. The majority of ulcer and cancer cases which have come to the author's knowledge were previously diagnosed as gastric neurosis, not to mention the cases in which organic diseases of other organs were found as the cause of the so-called nervous dyspepsia.

Relation Between Gastro-Intestinal Disturbances and Gynecologic Disorders. J. C. Hirst⁷ expresses the opinion that if it were the rule to examine women suffering from gastro-intestinal disturbances by a careful pelvic examination where a careful questioning elicits any symptoms pointing toward pelvic or abdominal complications, the results of treatment would be noticeably better and many patients would be restored to health who would otherwise have to progress as best they could with only a part of their ailments recognized or corrected. The conditions most likely to be responsible for reflex symptoms are the following:

1. Diastasis of the abdominal recti muscles. Hirst has found that a diastasis of less than four fingers' breadth is not as a rule productive of symptoms. Anything over this, however, results in a marked loss of support, and varying degrees of visceroptosis, particularly of the liver and colon. The stomach is involved to a lesser degree. Many such cases result from the practice of discarding the abdominal binder after delivery, either altogether or at too early a date. They can be treated by either a binder or straight-front corset, and in bad

(7) Amer. Jour. of Gastro-Enterology, April, 1912. by Google

cases the Webster operation alone seems to give relief.

2. Floating kidney usually does not give marked symptoms except for the small number who suffer from Dietl's crises, but it is well known that floating kidney and appendicitis are often closely associated, and in this way reflex symptoms can surely be looked for.

3. Retroversion of the uterus is one of the chief pelvic causes of reflex symptoms in the gastro-intestinal tract, second only to salpingitis. When the anatomic structure is considered it can easily be understood how this is so. The displaced uterus lies directly upon the rectum; if it is retroflexed the pressure is often enough seriously to narrow the lumen of the bowel, and no one need be told the effect of so interfering with the normal and complete evacuation. In such a case permanent cure is out of the question until the retroversion is corrected either by a pessary in a case free from adhesions, or by operation in a case where the uterus being adherent cannot be replaced.

4. Antelexion of the uterus is essentially a disease of the nulliparous woman, and could influence her condition only by the neurosis accompanying the mental strain of constantly recurring severe dysmenorrhea.

5. Salpingitis. In this we have, in Hirst's opinion, the most important factor in causing reflex gastro-intestinal disturbance. The adhesions on the left side, by their pressure and contractions seriously involve the lumen of the sigmoid and rectum. On the right side the appendix is invariably involved and the resulting adhesions affect the caput coli and ileo-cecal valve. Often a loop or several loops of small intestine come down into the pelvis and are caught and held by adhesions, forming either an actual obstruction or at least a U-shaped loop like a plumber's trap, and acting precisely as a partial intestinal obstruction. These adhesions may occur in a woman remarkably free from pain, and are the most important factor in the causation of disturbances remote from the pelvic organs.

6. Pelvic peritonitis and pelvic abscess have results in no way different, except in degree, from those of salpingitis, but being so much more pronounced are correspondingly easy to recognize.

7. Tumors such as fibroids or ovarian cysts cause their trouble by direct pressure, a constantly increasing constipation being a common symptom.

8. Cancer from the generative organs involves the bowel only by metastasis, and at such a stage is, of course, hopeless and need not be discussed.

9. Unrepaired tears, especially of the perineum, form with retroversion of the uterus and salpingitis, the trio of disorders at the bottom of most of the reflex disturbances. When the support of the pelvic floor is removed a general ptosis occurs, even up to complete prolapse and inversion. With these organs comes the pouch of the rectum found in the rectocele, causing difficult defecation, often marked constipation and its attendant evils, and until the tears are properly repaired no permanent cure of gastro-intestinal disturbances can reasonably be looked for.

10. A fractured coccyx is accountable for reflex disturbances in this way. One of the most marked symptoms is considerable and in many cases very acute pain on defecation. The dread of this pain leads to constipation, by the very natural desire of the patient to save herself as much pain as possible by the infrequent evacuation of the bowel. Palliative treatment for a fracture of the coccyx of long standing is worse than useless. Removal is the only course.

DYSPEPSIA NERVOSA.

Neurotic Dyspepsia. G. Rankin⁸ describes a form of dyspepsia to which he gives the title neurotic dyspepsia. The symptomatology of this type is somewhat as follows: The patient is most frequently a man, generally at or past the meridian of life. He usually comes with a story of impaired digestion continuing over some months or even years, but latterly becoming more intense and definite in its manifestations, and giving rise to such recurrent discomfort that his life is rendered wretched. He is mentally depressed, complains of inertia, insomnia, occipital headache, and loss of flesh, together with some of the other multiplex evidences of neurasthenia. He at-

(8) Brit. Med. Jour., Dec. 9, 1911.

tributes his decreasing weight to the care he takes to limit his food, because, though his appetite is vigorous, he fears to satisfy it. The pains in his stomach from which he suffers came at first irregularly, but they now recur in periodic attacks. They subside immediately after a meal, but reassert themselves unfailingly three or four hours later. They are accompanied by heartburn, and often also by waterbrash; subsequently vague impressions of fulness, weight, gurglings, and colicky spasms in the region of the epigastrium give rise to uncomfortable and distressful feelings of misery. Eructations are frequent, and seem to give such relief that the patient unconsciously swallows air in order to afford himself the comfort of regurgitating it. Repeated and almost uncontrollable yawning is often experienced. He becomes extremely introspective and nervous about himself, is subject to palpitation, sensations of faintness, spasmodic tightness of the chest muscles, and sometimes shortness of breath, for which no adequate reason can be found. When the discomfort has reached its acme, mouthfuls of acrid fluid containing part of the residue of his last meal are not infrequently regurgitated. Vomiting is not common, but, when it occurs, immediate relief ensues; so much so that some patients induce sickness that their comfort may be restored. There is always obstinate constipation. Under treatment the discomforts lessen, and may finally disappear for several months or longer, but are liable to become re-established under the provocation of mental or physical strain. On examination it will be found that there is tenderness in the epigastric region, often specially marked and limited to the right of the middle line, and that the stomach is frequently more or less dilated, splashing sounds being easily elicited in many instances. In doubtful cases part of the stomach contents may be siphoned off and examined chemically, when they will usually present an excess of total acidity, and especially an increase in the free hydrochloric acid. Whenever it is ascertained that the gastric symptoms follow a course parallel with the mental or moral state—being initiated under the influence of anxiety and worry, aggravated by the increase of these conditions, and relieved by their removal—it

may be reasonably inferred that the gastropathy is of nervous origin.

He reports 20 cases. This type of dyspepsia is frequently mistaken for duodenal ulcer and this affords good reason for delaying operative interference until medical measures have had a sufficient chance to prove that they are of no avail in clearing up the symptoms. It is possible that this form of dyspepsia is often the forerunner of duodenal ulceration, but, in that event, may its early recognition and suitable treatment not be the means of arresting the functional disease and of thereby saving a certain number of sufferers from the anxiety and risk of a surgical operation? The contention that immediately a chronic duodenal ulcer is diagnosed it must, without loss of time, be treated surgically cannot, in the face of cases such as the foregoing, be maintained.

In neurasthenic patients there is a hypersensitiveness of all the tissues. This is participated in by the gastrointestinal mucous membrane, and probably permits gastric juice of normal acidity to produce symptoms similar to those described as due to hyperchlorhydria. Some authorities are of opinion that no such condition as hyperchlorhydria really exists, and that an ordinary acid dyspepsia due to an excessive secretion of normal gastric juice is capable of causing most of the symptoms ascribed somewhat indiscriminately to hyperchlorhydria and duodenal ulcer. This opinion is strengthened by the fact that estimates of free hydrochloric acid have proved inconsistent, not only as between case and case, but also in the course of repeated investigations of the same patient. The combination of a supersensitive mucous membrane with an excess of gastric juice must tend to aggravate the subjective phenomena, and make them, by their intensity, the more readily mistaken for an organic lesion.

The author believes that the symptom of "hunger pain" has been too strongly insisted on; and he protests against the assertion that recurrent severe hyperchlorhydria is duodenal ulcer, and also against the statement made in one well known surgical text-book that: "In our experience, hyperchlorhydria has never existed

without ulcer in the stomach or duodenum or both." The author states: "There is ample evidence for believing that all the symptoms described as characteristic of duodenal ulcer may be reproduced by a simple functional disorder of the stomach, whether it be called neurotic dyspepsia, hyperchlorhydria, or whatever it be called.

The *treatment* of this variety of dyspepsia demands care as to diet, exercise, and habits of life generally. It is essential to the attainment of a satisfactory result that the patient should be somewhat self-denying and willing to co-operate with the physician in carrying out over a sufficient length of time all the details of a well-considered course of management. If his illness has lasted over any prolonged period, the misery it has caused is worth a serious effort to get rid of; and if, as is not unlikely, this form of dyspepsia is a stage on the road to ulceration, no preventive means that can be adopted are too elaborate to effect an escape from the risks of such a culmination. Moreover, it is only by a process of careful observation and supervised treatment that the question of the need for surgical intervention can be wisely settled.

All treatment should aim at being sedative, not only to the stomach but to the whole nervous system. In cases of moderate severity the daily routine of life need not be seriously interfered with. A suitable regulation of the diet and restriction of mental and physical effort must, however, in every instance, be insisted upon. If the symptoms are urgent and the patient wishes to get the most speedy and permanent benefit, he should consent to spend a week entirely in bed, and preferably in a nursing home away from the usual domestic environment. During this resting period his routine ought to be somewhat as follows: In the early morning a tumblerful of water as hot as can be borne, to which a small teaspoonful of citrate of potash has been added, should be sipped slowly. This should be followed by a hot bath at from 98° to 102° F., in which immersion may continue for from eight to ten minutes. After vigorous friction with a rough towel, he must return to bed and to breakfast, which should consist of *café au lait* or milk

tea, sweetened with saxon; ordinary toast and caseoid or other starchless bread in equal proportions, with abundance of butter; bacon, tongue, cold ham, eggs, cold game, or white fish. About ten o'clock he should be massaged for an hour, and thereafter remain for another hour quietly at rest. Luncheon, about 1 o'clock, should consist of a grilled chop or steak, or a cut from a joint, cooked green vegetables, a compôte of fruit *au naturel* or sweetened with saccharin, a biscuit or oatcake with butter and a morsel of cheese, an alkaline table water, to which may be added, if desired, an ounce of whisky or brandy. In cases where indican in the urine and offensive stools point to putrefactive changes in the intestine, the cheese should be of the "soured-milk" variety. A short sleep after luncheon is advisable. At 4:30 a cup of China tea or of cocoa infused from the nibs, sweetened with saxon and enriched with cream, will prove grateful, and may be accompanied by crisp dry toast and butter. A visit from one or two intimate friends should be arranged for the interval between tea and dinner. The patient should dine about 7, and the meal should consist of a small cupful of clear consommé, white fish, chicken or game, purée of vegetables, a simple omelette, and one or two glasses of a light Moselle or hock if desired. "Akoll" or de Voet's biscuits should be taken with luncheon and dinner rather than ordinary bread. Before retiring for the night at 10 o'clock, the abdomen should be gently massaged for a quarter of an hour, and the morning tumblerful of hot alkaline water ought to be repeated. For another week this plan should be continued, but with the difference that during the afternoon of each day a drive in an open carriage, followed by a short walk, is desirable. Thereafter a resumption of the ordinary duties of life may be permitted, but the engagements of every day should be limited, and the same diet plan continued until for at least a fortnight there has been no recurrence of stomach symptoms.

Medicinally attempts should be made: (a) To control the glandular secretions of the stomach and lessen the hypersensitiveness of its mucous membrane; (b) to counteract hyperacidity when it arises; (c) to overcome

constipation. These indications may be met by a variety of drugs. The following combinations are the outcome of many experimental efforts in this direction, and Rankin has found them to effect the desired result in a large proportion of cases:

- (a) Solution of atropine, solution of hydrochlorate of morphine, solution of adrenalin chlorid, and spirits of peppermint in suitable doses to make up 1 dram. To be diluted with one tablespoonful of water and taken a quarter of an hour before breakfast, luncheon, and dinner.
- (b) Magnesium carbonate, sodium bicarbonate, bismuth salicylate, and ginger. To be dispensed in a cachet and taken whenever heart-burn declares itself. A second cachet may be taken after an hour if the first does not succeed in overcoming the acidity.
- (c) Acetic extract of colchicum, aloin, capsicin, and extract of rhubarb. To be made into a pill and taken every alternate evening before dinner.

Carlsbad salts or Kutnow's powder in a suitable dose is useful before the morning tumblerful of hot water if the above pill proves inefficient.

After the gastric symptoms have disappeared and the digestion has again become normal, the diet may be modified, especially in the direction of including a larger amount of farinaceous food with a limited quantity of sugar, and some advantage will accrue from suitable tonics. These must vary according to circumstances, but in many instances the indications will be met by such a combination as this: Carbohc acid, valerian, sodium arseniate, and cannabis indica, to be dispensed in a capsule, and taken three times a day after meals.

The morning tumblerful of hot alkalized water ought to be continued as a matter of daily routine. Sugar and starches should always be taken in moderate quantity. A Turkish or electric-light bath once in eight or ten days, followed by general massage for twenty minutes, is a desirable practice in many cases.

It is important to secure, as far as possible, a clean condition of the mouth. To this end, all stumps and

carious teeth ought to be removed, and the buccal cavity rinsed out twice or three times a day with a solution of suitable strength of glycothymolin, listerine, carbolic acid, or other reliable antiseptic.

[This rich neurasthenic may well enjoy the illness and the doctor too. For him that has the money this treatment or that of a high price sanitarium promises an enjoyable cure. For the poor patient a doctor who will make him do general and personal hygienic tasks out-of-doors and at table, a cure may also be promised without the use of so many drugs, both pharmaceutical and proprietary.—B.]

Nervous Indigestion. G. M. Niles⁹ advises a very thorough examination of nervous dyspeptics which will furnish a cue by which a preliminary treatment may be inaugurated which may consist of hydrochloric acid and pepsin in case of hypochlorhydria or of alkalis for hyperacidity. A point which he considers almost the keynote of the treatment is to change the medicine in some way, even though it be simply a change of appearance every few days. These neurotic alimentary tracts must be kept guessing all the time. He often adds to an alkaline powder of calcium, magnesium, and bismuth a little pulverized charcoal or carmin, to the increased satisfaction of the patient. The active and indicated base of the prescription may remain the same so long as the adjuvants are frequently varied.

Psychic Indigestion. G. M. Niles¹ calls attention to indigestion of psychic origin which is explicable in the light of the researches of Pawlow and Cannon, and reports a number of illustrative cases. The first mental perversion may disturb the stomach, and the perversion of the stomach in turn may arouse in the mind greater disturbance, and thus between them the influence may continue to and fro like a pendulum until digestion is seriously impaired and functional derangement may merge into organic changes. He treats these patients with rest, if necessary, in bed for some time if there is fever, otherwise intermittent rest especially after the main meal at noon, and early bedtime to relieve the circulation. He finds that many of these patients sleep on

(9) New Orleans Med. and Surg. Jour., November, 1911.
(1) Med. Record, Oct. 14, 1911.

their stomachs, a position allowing the kidney to float in position. He, therefore, advises them to place bricks under the foot of the bed to facilitate the replacement of the abdominal organs, empty them, and increase the flow of blood to head and chest.

He recommends a careful selection of diet, hot, moist applications, later the cold sitz-bath and douches, with some general tonic and hydrotherapeutic measures at night if sleeplessness is complained of, atropine or belladonna, sodium sulphocarbolate (phenolsulphonate) or some other intestinal antiseptic, and other drugs that may be indicated to influence the gastric and nervous symptoms.

A well-supporting bandage is indicated in almost every case. Most of the bandages on the market are cumbersome and do not support; they fit to the abdomen like a glove and not at all in thin persons. Niles has designed a bandage that meets the indications. It consists of a piece of elastic, which is fitted above the pubes in front and held by leg-straps and three elastic straps buckled to a second shield across the spine. These straps secure a backward and upward pressure and are easily regulated by the patient so as to be comfortable. The bandage is not cumbersome and gives full support.

Therapeutic cognizance must be taken of tangible bodily ailments, and appropriate medication has its important place here, as in other more material troubles. He, however, who attempts to reach these shifting and evanescent psychoses by a hide-bound system of dietetics, stomachics, digestants, tonics, or any other adventitious aids to digestion will be foredoomed to failure. Along the line of uplifting suggestion the "isms" and cults have won some of their spectacular victories, and the medical profession has been far too slow to gather from these erratic creeds the few real jewels contained therein.

Another therapeutic measure which often proves of benefit is a radical change of occupation or environment. To send the tired city dweller into the country; to transport the lonely dyspeptic from the farm to the busy turmoil of the city; to take the "indoor man" from his books or counter and put him "on the road;" or to give the worn traveler a quiet occupation, will in many in-

stances change the diseased current of thought, banishing the subjective symptoms, the introspection, the self-analysis, the self-pity. When the minds of these sorrowful invalids are taken from their stomachs; when their daily thoughts are lifted out from introspective ruts; when their ill-nourished bodies are furnished sufficient food, and their desiccated tissues are laved with an abundance of water—then can the vicious circle be broken and the psychic aids to digestion resume their normal place in the bodily economy.

The Cause of Pain and Discomfort in Dyspepsia.

Treatment. F. J. Wethered² attributes the pain and discomfort experienced in dyspepsia to the following causes: (1) The distention of the stomach brought about by the accumulation of gases evolved by faulty digestive processes (if the distention is only slight a sense of fullness and discomfort is felt; if the distention is greater there is actual pain); (2) the existence of free hydrochloric acid, which causes an increase of peristaltic action of the stomach (the acid may also produce a spasm of the pylorus, which causes the pyloric orifice to be closed and so by preventing the exit of gases intensifies the symptoms); and (3) the presence of alcohols evolved in the stomach. The time-honored plan of giving alkalis in certain cases affords relief by neutralizing the acid and so lessening the increased peristaltic action. It is obvious, however, that a more effective plan to relieve the symptoms would be to empty the stomach of the contained gases and the retained and more or less altered food. This is best done, Wethered says, by emptying the stomach into the duodenum by Mitchell's method. When the surface of the skin immediately beneath the left costal arch is gently stimulated with the fingers, contraction of the stomach occurs. The stimulation must be brought about by stroking the skin very lightly; if too much pressure is used a spasm of the pylorus seems to be produced, and gas and fluid are then unable to pass through the pyloric opening. When contraction of the stomach occurs, as evidenced by the sounds heard by the phonendoscope, the stroking must at once be stopped until the bubbling or gurgling sounds have also ceased, oth-

erwise the nervous impulse seems to become too strong and the contraction ceases. When the sounds have stopped the stimulation is again resorted to and so on until the stomach has been emptied, as shown by the results of auscultatory percussion. The procedure is best carried out four hours after a meal. In most cases, once a day for about a week or ten days is required and the interval may be lengthened, every two days, every third day, and so on, until all symptoms have disappeared. At the same time the diet must be carefully regulated. The most important point is suitable spacing of the meals. Three meals a day must be prescribed; breakfast at about 8:30 to 9 a. m.; lunch from 1 to 1:30 p. m.; and dinner at 7 to 8 p. m., nothing whatsoever being taken in the intervals. In this way the stomach has complete rest between the meals and thus has a proper chance of emptying itself, being assisted once a day by the method described.

Impotence of Drugs. H. N. Leavall³ calls attention to the frequency with which symptoms of dyspepsia arise from changes in secretion which drugs have no power to cure, or from disease of other organs than the stomach which must be met by appropriate measures, usually surgical. Leavall concludes as follows:

Having no drugs by which we can stimulate normal cell activity, and no drugs by which we can influence the secretion of one organ except to the detriment of another, or the production of a pathologic lesion in the organ which is stimulated, we can safely assert that medicines must necessarily play a minor rôle in the cure of indigestion. So far as pathologic lesions are concerned, they can have absolutely no effect for the reason that a lesion which is sufficient to cause enlargement of an organ may sooner or later, by metastasis, affect other organs, or by throwing out numberless adhesions, may produce acute intestinal obstruction.

HYPERACIDITY.

Hypersecretion. C. S. Fischer⁴ presents as follows the pathogenesis of hyperchlorhydria and hypersecre-

(3) Kentucky Med. Jour., Jan. 15, 1911.

(4) Med. Record, Oct. 21, 1911.

tion: The tendency of every normal stomach is to hypersecrete upon insult, and if the insults are frequent enough, a habit of hypersecretion may be established. Arrived at this stage each digestive act is accompanied by an excess of secretion, and the intervals between the occasional attacks of ordinary hyperchlorhydria are shortened. In this manner a permanent condition of hyperchlorhydria is developed. Such individuals always exhibit an excess of acid with each food ingestion. They may or may not exhibit symptoms of the condition. These stomachs always empty themselves between meals and no acid is found. These cases represent by far the greatest class of our chronic dyspeptics and give the common symptom-complex of gas eructations, pyrosis, and painful pressure coming on at the end of the digestive act. In this condition they may remain stationary for years.

There is always danger, however, that this more or less physiologic hyperchlorhydria may develop into a hypersecretion by extension into the interprandial periods. Upon this conception the diagnosis of hypersecretion is based. Such extension may be apparent or real. It is real only when the motor functions of the stomach remain normal. In the advanced stages of excessive acid secretion, when motor interference of one sort or another has been established, it is generally impossible to say which condition is present. The volume of the gastric contents at this stage may be due either to retention or hypersecretion. The differential diagnosis can only be made early and all the arguments constantly advanced as to the obstructive nature of the Reichman complex are necessarily futile. With retention once established the determination of excess volume and acidity need not indicate a hypersecretion.

A positive diagnosis of hypersecretion *per se* postulates a normal motility. There can be neither retarded or accelerated muscular activity of the stomach. In the first instance the excessive secretion may well be a mechanical manifestation; in the second it may be only apparent. Attention of late has been directed to the relation existing between hypermotility and hypersecretion. It should be remembered in this connection that the same

influences which affect the secreting structures also affect the muscular structures. It is not reasonable to suppose that causes activating the one function should depress the other. Clinical experience confirms this, for the early association of apparent hypersecretion and hypermotility is a matter of common observation. Such stomachs empty themselves very rapidly, but contain acid fluid within the normal digestive period following ingestion. Analysis of this fluid reveals only a slight difference between free and total acidity. To diagnose hypersecretion in all such cases would be manifestly an error, for the volume of the secreted juice may be directly proportional to the original stimulus. If this physiologic secretion leaves the stomach within a reasonable time after meals, it need cause no special symptom or disturbance. Such stomachs exhibit an excessive but physiologic activity. In this condition they may remain for years.

There is always danger, however, that the motor functions may be affected eventually. It should be remembered that the tendency of every hyperacid stomach is toward retention. It is a physiologic process in the beginning, instituted for protective purposes. Excessive gastric acidity must induce prolonged pyloric contraction. The duration of this reflex act stands in direct relation to the quality and quantity of the gastric juice. In itself it is purely a very active normal function. The time will come, however, when the passage of food will be retarded little by little and a vicious circle established within the organ itself. The retained food increases secretion, which, in turn, prolongs pyloric contraction and increases retention. Arrived at this stage we have the familiar combination of hypersecretion with retention, but this result has been attained gradually by more or less physiologic processes. Judging from practical observation of large clinical material and the examination at all stages, the development of these conditions is along fairly fixed lines. The primary insults induce hyperchlorhydria and hypermotility. As a result of the latter the stomach contains acid secretion during the interprandial periods. This, in turn, induces prolonged pyloric contraction. The time comes when food is retained. This causes additional secretion and the combination is

complete. The degree of development and the relationship between the secretory and the motor functions will depend more or less upon the period of examination.

Hyperchlorhydria with Absence of Hydrochloric Acid in the Stomach Contents. According to J. Friedenwald⁵ cases are not uncommon in which symptoms of hyperchlorhydria exist, and yet the gastric contents show a diminution or a complete absence of hydrochloric acid. This condition is explained on the basis of a gastric hyperesthesia. In addition, there are a certain number of cases manifesting similar symptoms, in which the gastric contents present a normal or a lessened proportion of acid, and yet in which, during the earlier periods of digestion, a hyperchlorhydria is at hand. Roth and Strauss first drew attention to this condition, but it was more carefully investigated by Schuler, who termed it "hyperaciditas larvata."

In the larval hyperacidity, there is an actual hyperacidity which is often not revealed, inasmuch as the gastric contents are not extracted early enough, because the secretion, which at an earlier period would present a hyperacidity, is gradually neutralized before the end of an hour when taking an Ewald test-breakfast. Observations over a series of six cases have been made. Test-meals were given, and removed at varying intervals; and while the percentage of free hydrochloric acid was normal, and subnormal at the end of an hour after an Ewald test-breakfast, yet it was found that there was a period in which a hyperchlorhydria was manifested.

Treatment. H. Winternitz⁶ has investigated the action of solutions of hydrogen peroxid on the acidity of the gastric juice and reaches the following conclusions: Pure solutions of hydrogen peroxid in slight concentration reduce the acidity of the stomach to a considerable extent immediately after administration but they produce no permanent effect. For this reason and because they are not tolerated for regular treatment the author has discarded them after considerable experience, although he would be glad to learn that this plan of treatment has succeeded in other hands.

(5) Boston Med. and Surg. Jour., June 1, 1911.

(6) Deutsche med. Wochenschr., July 27, 1911.

SPASTIC STOMACH.

H. Eppinger and G. Schwarz⁷ report a complicated case in which there was marked enlargement of the cervical glands, enlargement of the liver and spleen, and a considerable edema of the lower extremities without evidence of any heart or kidney lesion. Serious symptoms on the part of the stomach were present consisting in frequent vomiting and stasis of the gastric contents. An *x-ray* examination showed the pylorus markedly contracted, thus suggesting the existence of an organic stenosis.

Atropine was administered with very favorable results. The vomiting ceased and the retention of contents could no longer be demonstrated. The *x-ray* picture was also changed so that the contraction of the pylorus disappeared. The patient, however, died from extreme weakness and the necropsy showed marked enlargement of the lymph-glands with a small chronic cavity in the apex of the right lung. The right brachial vein was compressed by a lymph-gland, and was somewhat eroded. The thrombus which had formed in this part extended into the right auricle. The liver, spleen and kidney had undergone amyloid degeneration. The stomach, however, was unaffected. The mucous membrane was intact and showed no scars or hemorrhages. Microscopic examination of this organ showed no amyloid degeneration.

The authors conclude as follows: The most severe symptoms of a spasm of the stomach may exist without any sort of anatomic change such as erosions, ulcers, etc., of the stomach or of the immediate surroundings. In these cases atropine is a remedy well suited to distinguish mechanical from functional stenosis. Finally the coincidence of a high degree of spasm of the stomach with amyloid degeneration of the adrenal bodies should be noted.

(7) *Wien. med. Wochenschr.*, Oct. 7, 1911. Digitized by Google

VOLVULUS OF THE STOMACH.

T. Tuffier and Jeanne⁸ report a typical case of volvulus of the stomach with a review of the literature. They discuss the mechanism and location of the torsion, emphasizing that the situation of the vessels and not the aspect of the twisted stomach should be the guide to estimate the degree of torsion. As the stomach dilates, this has a tendency to correct the torsion, until the dilatation becomes so extreme that the stomach is incarcerated. Only one case in a child is on record. Under prompt operative treatment, 60 per cent. of the patients recovered; untreated, total volvulus is speedily fatal. This was determined, in addition, by experimental volvulus induced in dogs, although the dogs bore without harm a partial volvulus. In operating, the stomach should be anchored so that it will not twist again later.

ORGANIC DISEASES.

GASTRIC INFECTIONS.

L. Cheinisse⁹ calls attention to the gastric symptoms occurring at the beginning of various infectious diseases which are probably attributable to the general intoxication. Aside from these conditions he has noted in a number of cases symptoms which indicate an actual localization of the infectious agent in the stomach,—a localization which manifests itself clinically not at the beginning of the disease but when the affection is at its height or even seems to be declining. It is no longer a gastric state, "*état gastrique*," more or less vague, with which we have to do, but there is observed the development of a genuine infectious gastritis, which, instead of merging in the symptomatology of the causal disease, tends on the contrary to dominate the clinical picture and requires to be taken into consideration. He reports two cases illustrating this affection, one in which the disease developed in the course of a facial erysipelas and presented very serious symptoms although

(8) Rev. de Gynéc., January, 1912.

(9) Sem. Méd., Aug. 30, 1911.

the erysipelas itself was moderate in its severity. The other case occurred in the course of mumps.

These clinical facts are supported by recent investigations undertaken by E. Jerusalem at the Augusta Hospital in Berlin, showing the changes in the gastric mucosa in acute infectious diseases. These investigations were carried out on a series of cases of measles, diphtheria, whooping cough, epidemic meningitis and septicemia, and revealed the presence of constant changes in the stomach consisting chiefly of interstitial gastritis with proliferation of the connective tissue. In whooping cough the interstitial changes are very slight, the gastric mucosa presenting rather the changes seen in parenchymatous degeneration. Although the constancy of these changes is in sharp contrast with the symptoms manifested during life the author regards it as impossible to subscribe to the current opinion that these gastric symptoms are purely functional arising from the general infection of the organism.

From a practical point of view the question is not lacking in importance, for it goes without saying that the presence of a gastric localization in the course of erysipelas may be of a nature to require serious reserve as to prognosis, especially when we remember that a phlegmon of the wall of the stomach is not such an exceptional event as has been claimed until quite recently. On the other hand these cases raise some questions with regard to therapeutics. One may ask whether the employment of emetics, which is almost the rule according to current practice for combatting the gastric symptoms in acute infectious diseases, may not be more injurious than useful. Like every inflamed organ the stomach has need in such circumstances to be put to rest, and emetics are contra-indicated as well as all premature attempts at alimentation. At least the diet during the acute period of the disease should be liquid.

UREMIC GASTRITIS.

P. Courmont and A. Cade¹ report a case of the rare lesion of ulceration of the stomach occurring on the basis

(1) Prog. Méd., Feb. 3, 1912

of uremia. The patient was a widow, aged 71, without special previous history, who entered the hospital with functional dyspnea and slight cough without expectoration. There was evidence of deficiency of heart action and slight amount of albumin in the urine. A marked melena appeared without hematemesis and the patient succumbed a few days later. The necropsy showed slight lesions in the heart and lungs but insufficient to account for the dyspnea observed. The stomach contained much liquid blood and in the region of the greater curvature two quite deep ecchymotic ulcers, one narrow and elongated, the other round, of the size of a ten-cent piece. These ulcers were with certainty recent. The kidney showed lesions of sclerosis.

The authors divide hemorrhages from ruptured arteries in the stomach into three groups: A. Erosions with a ruptured arterial aneurism. B. Erosions with a ruptured artery but no aneurismal dilatation. C. Arterial lesions in the neighborhood of an ulcer but without any evidence of a broken vessel. They regard their case as not fitting exactly in any of these classes and place it by itself as an ulceration of the stomach occurring in consequence of uremia.

Comparatively few cases of ulceration of the stomach due to uremia have been reported. The authors review the literature and present certain conclusions relating to the causes, the lesions, and the clinical expression of uremic ulcerating gastritis. This condition occurs only in cases of chronic nephritis of a predominatingly interstitial type. It is rare in young persons. From an anatomic point of view there are several things worthy of notice: The quite frequent multiplicity of the ulcers, their various localizations in different regions of the stomach, their macroscopic appearances with the borders not thickened, their variable forms and the slight or absent reaction on the part of the peritoneum, their microscopic characters indicating a transition between the necrotic type and inflammatory lesions, and finally, their frequent association with other gastric lesions which are common in the course of uremia. These lesions are congestion, hemorrhagic infiltration, and simple erosions, of a superficial character which are multiple with irreg-

ular borders. Notwithstanding their striking characteristics it is sometimes difficult to decide whether a case represents a uremic ulceration or a simple ulcer occurring in the stomach of a uremic patient. As to the clinical manifestations of this form of gastritis three principal classes may be made. The first, which is the usual one, is represented by no symptom which would induce the clinician to make a very careful examination of the digestive apparatus, and consequently is a necropsy finding. The second is characterized by some vague pains in the stomach. In the third form *gastrorrhagia* showing itself by *hematemesis* or by *melena* raises the strong suspicion of a gastric or duodenal ulcer, although a similar syndrome can be produced independently of any ulceration, by transudation in consequence of congestion of the mucosa. This hemorrhagic form of uremic ulcerative gastritis presents a very serious prognosis. At the present time with the resources furnished by the examination of the feces for occult blood the condition may be discovered sometimes before the occurrence of evident hemorrhage, and in any case it is possible to make a diagnosis of ulcerative processes more frequently than formerly.

The diagnosis of this form of ulceration depends on the sagacity of the physician taking such a broad view of the case that the existence of uremia in connection with such gastro-intestinal symptoms as have been described does not escape him. Given an ulcer of the stomach attested by the presence of blood in the feces and possibly by other kinds of hemorrhage the existence of arteriosclerosis is not enough to place it in the class under consideration. There must be in addition signs of the uremic condition.

GASTRIC CATARRH.

Diagnosis. The diagnosis of gastric catarrh is discussed by J. A. Work.² Decreased appetite, dizziness, belching and coated tongue, cachexia in advanced cases, and constipated bowels are the usual symptoms.

Gastric analysis; macroscopic. One hour after an Ewald test-meal the stomach contents show lessened or

absent hydrochloric acid (free and combined) and a low total acidity. The gastric juice is of low enzymotic power. Mucus being present in increased amounts immediately suggests gastritis. The food is imperfectly digested or not digested at all. The remains of biscuit are in large bits and tend to float. The mucus and bread are intimately mixed, characteristically so. The surest way of recognizing mucus, when not present in large quantity, is by pouring the stomach contents from the container into a beaker, or on to the filter, and noting the way the particles of food are held tenaciously together in a stringy, sticky mass. In the absence of mucus, the particles of food show very little cohesive properties and each separates easily from the other (Weinstein).

Gastric analysis; microscopic. The microscopic examination of the gastric contents in chronic catarrhal gastritis is of paramount value. Starch granules take a very faint stain with iodine solution. After a meat meal, the muscle fibers present very marked striæ, being unchanged through lack of gastric juice. Mucus is recognized as dark, stringy masses, holding entangled in their meshes a large number of epithelial cells and round cells resembling leukocytes. A vast number of bacteria are found. Pilcher tabulates the following varieties as being most consistently found in chronic gastritis: Streptococci (127 cases), colon alone (8 cases), streptococci and colon (64 cases), diplococci (84 cases), lactic acid bacilli (42 cases).

For examination of the number, types, and state of health of gastric cells found free in the stomach, Bassler's technic is as follows: Give the patient a light supper. Next morning aspirate what contents happen to be in the stomach. Then have the patient drink the following solution: 250 c.c. of water, twenty-one grains common salt, one grain each of sodium sulphate, sodium carbonate, and sodium phosphate. The patient exercises vigorously, and his abdomen over the stomach is gently tapped with the finger tips. The contents are aspirated after five minutes and allowed to stand for several hours. The upper part is then siphoned off and the sediment in small lots centrifugated. Cover glass preparations are

made and stained with hematoxylin and eosin. The various cells present the following characteristics:

Acid or parietal cells stain readily. They are between leukocyte and squamous cells in size; the nucleus is near the periphery of the cell. The cell protoplasm shows a confluent stippling with eosinophile granules. The cells are irregular in shape, some are oval, and the nuclear membrane is well defined. The nucleus is usually lighter and a trifle larger than those in peptic cells, and it stains in a blotchy manner. The presence of these cells is important in diagnosing atrophic gastritis.

Peptic or central cells stain poorly, the body of the cell just barely, the nucleus better. The nucleus stains deeply and uniformly and no nuclear membrane nor granules can be discerned. Peptic cells lie between acid cells and leukocytes in size. They may be mistaken for uninuclear lymphocytes. Sometimes just a shred or a very narrow band of protoplasm around the nucleus is stained.

The following points are important and should be remembered:

1. A large percentage of cases of chronic catarrhal gastritis accompany other more general diseases.

2. Gastritis is a definite pathologic entity, not a neurosis. A careful examination of the stomach contents will differentiate it from a neurosis. The presence of mucus with incorporated epithelial cells and diminished secretory activity is valuable.

3. Diagnosis in doubtful cases must be reserved until several stomach analyses have been made.

4. In carcinoma reduction of free acid and of peptic power are early symptoms, while in chronic gastritis they appear late. (Riedel.) The marked chronicity of gastritis and the rapid course of cancer are important distinctions.

5. The pain of gastritis is milder and more diffuse than that of ulcer. There is no hematemesis in a pure gastritis, though evidence of minute hemorrhagic erosions may be found in the recovered contents or vomitus.

6. The three most trustworthy points in making a positive diagnosis are (a) microscopic or cyto-analysis, (b) reduced zymogen and hydrochloric acid secretion, and (c) abundant formation of mucus,

ACHYLIA GASTRICA.

Leukocytes in Achylia Gastrica. I. A. Waledinsky³ records the results of leukocyte counts in cases of achylia gastrica simplex compared with similar counts in carcinoma, and finds in general that achylia is characterized by a reduction in the number of neutrophils with a relative increase in the mononuclears and lymphocytes, particularly the latter. If this relative finding can be confirmed on a large number of cases a marked contrast will be shown between this disease and carcinoma, for the malignant disease is characterized by an increase in the number of leukocytes due to the relative and absolute increase in the polynuclears. This difference may be of diagnostic significance. At any rate it indicates the importance of blood counts in diseases of the stomach, and investigations should be continued.

Urinary Pepsin. H. Scholz⁴ reports his results from the examination of 66 cases of achylia gastrica and carcinoma of the stomach in which he reached the conclusion that the simultaneous failure of pepsin both in the stomach and in the urine was the rule in cases of uncomplicated achylia, while in carcinoma there was not rarely a more or less marked amount of pepsin in the urine while the gastric juice contained none. He concluded from this that the claim was justified that the recognition of abundant pepsin in the urine with a lack of the ferment in the stomach must be interpreted in clinically doubtful cases as opposed to the diagnosis of achylia and favoring the diagnosis of carcinoma. He discusses the views of Takeda and comes to the following conclusion:

In doubtful cases of carcinoma of the stomach, if the urinary pepsin is demonstrated in normal or excessive amount while the stomach contents obtained after a test-breakfast show no peptonizing power, and this finding is confirmed by the administration of a bouillon-breakfast, this result must be interpreted in favor of the diagnosis of carcinoma.

Achylia Gastrica with Fatal Cachexia. W. Rindfleisch⁵ reports a case of serious cachexia arising from

(3) Deutsche med. Wochenschr., Aug. 31, 1911.

(4) Deutsche med. Wochenschr., July 13, 1911.

(5) Deutsche med. Wochenschr., Jan. 11, 1912.

achylia gastrica without any other anatomic basis. The diagnosis of tuberculosis was disproved by repeated examinations of the sputum and a careful examination of the lungs both by ordinary physical diagnosis and by examinations with the *x-ray*. There was no diabetes nor amyloid degeneration. The most difficult point in the diagnosis was the exclusion of carcinoma of the stomach. The whole thought of the patient was given to his subjective complaints limited to the digestive organs. The author, however, rejected this diagnosis, also because after repeated examination the stool was always found free from blood. Moreover, the examination of the stomach was repeatedly undertaken always with the same result, complete achylia and no disturbance of the motility.

The entire general picture presented a remarkable similarity to Addison's disease with its extreme emaciation, weakness and dark skin, but as the mucous membranes were completely free of pigment and the scars were very slightly affected this assumption was also rejected. The diagnosis, therefore, was confined to achylia gastrica. Inasmuch as there was no disturbance of the bowel functions it seemed probable that the intestinal mucous membrane was intact. Examination showed that the pancreas was also functionally active. Rindfleisch, therefore, concluded that the severe cachexia was the result of the achylia gastrica and that the case was similar in all essential points to one reported by Grawitz. This, he would explain by the production of toxins in the intestine in consequence of the failure of the antibacterial action of the hydrochloric acid. There are two types of these poisons, one producing a severe anemia without any marked reduction in the amount of fat and albumin and the other producing an extreme emaciation without any qualitative change in the blood. These different types Grawitz explains, not by a difference in the character of the poison, but by constitutional conditions in the mode of reaction of the affected individual. In the first group there is a diminished resistance of the red blood cells while in the second group the metabolism of albumin is affected.

The cases in which a simple achylia without disease

of the intestine leads to cachexia are very rare. In the author's case the necropsy showed an interstitial gastritis with similar changes in the intestine and liver. Apparently from the absence of important symptoms referable to the intestine the intestinal lesions played a slight rôle in producing the marked cachexia.

The diagnosis of such cases depends on the exclusion of three affections, carcinoma of the stomach, Addison's disease, and tuberculosis of a latent form sometimes seen in the aged. These diseases are to be excluded by the careful application of the diagnostic methods which are usually applied for their discovery.

The prognosis of this condition is serious. No special means of treatment are advised by the author beyond the usual treatment for achylia gastrica.

GASTRO-INTESTINAL ATROPHY.

Atrophy of the Stomach and Intestine. Golubinin and Kotschalowski⁶ discuss the subject of progressive atrophy of the gastro-intestinal tract and report a case with fatal termination and a necropsy. The necropsy showed a very extended, even a total atrophy of the gastro-intestinal tract with small old foci of fibrous tuberculosis in the right lung and in the mesenteric glands which appear to have taken no active part in the morbid process. The microscopic examination of the mucous membrane of the stomach and intestines showed such an extensive atrophy of the parenchyma as must have produced a very marked diminution of the digestive functions. These changes confirm the idea of Lubarsch who found as the result of his investigations that the structures of all parts of the digestive tract in advanced atrophy were very similar, and that the specific differences had disappeared. The pepsin glands atrophy and beaker cells take their place. The villi of the small intestine flatten out and the small intestine is difficult to distinguish from the large intestine. The whole digestive tract loses its elements of secretion and becomes converted into a smooth, thin-walled tube.

It is evident that with such a great extension of the

(6) Archiv f. Verdauungskr., Bd. 17, H. 6. Digitized by Google

process there can be no compensatory vicarious function of the unaffected parts of the digestive tract. The evident disturbance of absorption by the intestine contributes still more to the progressive loss of strength. This extensive atrophy of the gastro-intestinal tract consists in a severe pathologic process which may have a fatal termination. From the authors' case they conclude that the changes of the blood constitute a severe anemia secondary to the serious disturbance of the digestive functions. The morphologic examination of the blood and the slight reaction of the bone-marrow are opposed to the idea of an essential pernicious anemia and show that the blood suffered in connection with the general loss of strength. A nephritis developed in the latter period of the disease, most probably due to absorption of toxic substances from the intestines.

As to the etiology, a congenital weakness of the digestive organs must be assumed. As confirmation of this assumption certain objective indications of degeneration were present: a cardioptosis, enteroptosis, and a floating tenth rib.

It is well known that a long-continued catarrh may lead to atrophy of the mucosa, but how is the progressive course of these atrophies to be explained? The authors suggest that the inborn weakness of the digestive tract was aggravated by a reduction of the power of resistance by repeated labors. The authors suggest also that the possible participation of the central and sympathetic nervous system must be taken into consideration to explain these obscure and progressive pathologic processes.

EROSIONS OF THE STOMACH.

Hemorrhagic Erosions. Superficial erosions of the stomach were first described by Einhorn and are now termed Einhorn's disease. According to Einhorn this disease is a chronic condition characterized by diffuse pain which comes on shortly after eating and is not influenced by pressure, vomiting, or eating again, by a sense of great weakness; by a rapid loss in weight, and, pathognomonically, by the repeated presence of from two to four erosions (small pieces of mucous membrane)

in the wash-water from the fasting stomach. Einhorn's belief that this clinical picture was the expression of a distinct disease, has been upheld by Mintz, Berger, and others. Pariser, Nauwerk, and Elsner, on the other hand, have maintained that the basis of the picture has been a chronic gastritis, the ordinary symptoms of which have been forced into the background by the periodic appearance of the erosions and the bleeding.

N. W. Jones⁷ reports a case of this disease which terminated fatally and was subjected to necropsy. Briefly the anatomic findings were as follows: The body was that of a tall, heavily boned, greatly emaciated middle-aged man. The panniculus was pale and scanty; the peritoneum was smooth and glossy. All parenchymatous organs were very pale and dry. The heart and lungs were otherwise negative. Very small scattered atheromatous patches existed in the beginning of the arch of the aorta. They were absent throughout the course of the abdominal aorta. There was no gross evidence of terminal infection. The bone-marrow of the ribs was pale in color. The intestine and colon were more or less filled with dark, tarry contents that contained much blood. The stomach was of normal size, blanched, and contained a little turbid fluid. Over the mucosal surface a moderate amount of greyish, somewhat blood-stained, tenacious mucus was found. On the posterior wall about midway between the cardia and the pylorus were seen five small eroded areas with hemorrhagic margins and bases. They were superficial in character, not extending to the submucosa, and varied from the size of a split pea to 1.5 cm. in length and 1/3 cm. in width. No eroded vessels could be found.

The interstitial tissue of the epithelial layer of the mucosa is the seat of a dense, small round-cell infiltration. This infiltration is diffuse and more marked in the surface of the mucosa. The deposit of these small round cells is so dense that in many cases the stomach glands have been completely obliterated. Scattered throughout this dense infiltration are islands or portions of glands. Their lumina are distended to two or three times the normal size. The cell cytoplasm is granular and disintegrated

(7) Jour. Amer. Med. Assoc., Oct. 14, 1911.

and in many places the lumina are filled with a cytoplasmic débris. In the fundus region no differentiation of the gland cells occurs into parietal and chief cells. All gland-cell nuclei stain less deeply than normal. The capillaries in the mucous membrane are markedly dilated along the basement membrane and, in the region of the crypts, show a diffuse extravasation of blood. The bloodvessel plexuses in the submucosal and muscular layers show a thickening of the walls and a slight congestion. The muscular layer, submucosa and muscularis have to a slight degree an infiltration of small round cells.

An entire absence of proliferation of the connective tissue elements, the engorgement of the superficial blood capillaries and the manner in which the gland cells are destroyed sharply differentiate the process from the ordinary chronic gastritis. The claim, therefore, of Elsner and others that the disease is one of ordinary gastritis with the factor of erosion formation added to it is no longer tenable, and neither, on the other hand, is that of Einhorn, for the process must be classified as a type of chronic gastritis. It is, in fact, a chronic, non-proliferative, hemorrhagic gastritis.

GASTRIC ULCER.

Gastric Hemorrhage. N. Jacobson⁸ discusses gastric hemorrhage. Toxic erosion giving rise to hemorrhage is probably of general instead of local origin. Bolton, in discussing this condition states: "In severe anemias, in infective disease, in purpuric conditions, in toxemias associated with disease of the liver and kidneys it is a common experience to find the mucous membrane of the stomach intact when vomiting of blood has occurred during life."

The author reports an illustrative case in a child three days old. Singularly enough hemorrhage has occurred in the newborn much more frequently than in the adult. Our literature presents a great array of observations on this class of cases. It has been suggested that in many instances syphilis is responsible for this hemor-

(8) Amer. Jour. Med. Sciences, March, 1912.

rhagic condition in the newborn. That it is by no means a constant factor is generally admitted. Serious hemorrhages can occur, with perhaps no explanation for their occurrence.

The second patient was two days old. Three days after birth the child had a temperature of 99.6° F. On the following day her temperature was 100.5° F. in the morning and 104.4° F. in the evening. During the first twenty-four hours she vomited a dark brown substance. On the second day, material of the same character was repeatedly vomited. When the patient was thirty hours old, blood and mucus were found in the stools. When Jacobson saw the child she was still vomiting blood and likewise passing blood from the stools. She had had a general convulsion.

[It would be interesting to know if the mother of this child was anesthetized with chloroform during labor. Graham has shown that hemorrhagic disease (Buhl's Disease and others) is often due to chloroform narcosis of the mother.—B.]

Klebs, in 1875, was the first to discover micro-organisms in the hemorrhagic areas. He succeeded in producing hemorrhagic peritonitis in a rabbit by inoculating it with the hemorrhagic peritoneal fluid taken from a child who had died of this condition. Rehn, in 1877, reported the case of a child who died three days after birth from hematemesis and bloody evacuations from the bowels. At necropsy some thirty points varying in size from a pin-point to a pin-head were found in the mucosa of the stomach. Each presented an infiltrated base, in which micro-organisms were found. Babes, of Bucharest, was one of the earliest contributors to this field. He discovered specific organisms not only in the hemorrhagic areas, but also in infarcts in the spleen and lungs of a child dying when aged five days, and these he stated resembled the capsulated cocci of pneumonia. V. Dungen concluded that these hemorrhages resulted either from emboli or the damage done to the vessel walls by the production of toxins. In the inoculation of animals the pathologic changes he stated are found to be due to the latter. He is rather inclined to believe that the hem-

orrhagic conditions of early life result from the toxins rather than the bacillary invasion.

The authors consider next the occurrence of gastric or intestinal hemorrhage as the initial manifestation of a toxemia in the adult and present two cases. In one the hemorrhage was not externally visible, while in the other it was exceedingly profuse. In the last case a capsulated bacillus, probably the pneumococcus, was responsible for the toxemia which produced a profuse hemorrhage from the intestinal tract. Evidently the site of the disturbance was the duodenum, inasmuch as it was associated with marked gastric hemorrhage. It seems fair to assume in view of the thoracic manifestations which preceded the intestinal disturbance, that the portal of entry of the infectious organism was pulmonary. That capsulated bacilli are responsible for gastric or intestinal hemorrhages has been thoroughly established by Howard. After carefully reviewing the literature and work of others, and as a result of his own studies, he concludes that in the cases of hemorrhagic septicemia there has been found each time a pleomorphic capsulated bacillus.

That the pneumococcus is capable of producing such a hemorrhagic condition has been clearly demonstrated by Claisse. He refers to an unpublished case in the service of Hutinel at the *Hôpital des Enfants*, in which purpura followed upon pneumonia, and in which the pneumococcus was recovered not only in the purpuric areas of the skin, but also in infarcts in the kidneys and spleen, as well as from the endocardium. The character of the micro-organism was further established by the inoculation of mice and by cultures. He also demonstrated that the pneumococcus can enter the body and produce widespread pathologic changes before it awakens a pneumonia.

Babes has likewise carefully investigated the subject of the bacteria responsible for hemorrhagic infections in the human being. He also attempted to determine whether a single micro-organism is responsible for all types of hemorrhagic infections. He concludes that no single specific organism is responsible therefor. He analyzed in his article the labors of other observers as well

as his own, and arranges in columns, for the purpose of comparison, the clinical and laboratory features of the various micro-organisms. He studied their behavior upon various culture media, and by the inoculation of animals. He was able to determine that bacteria which cause hemorrhagic septicemia in animals do not conform in all respects to those which produce this disturbance in man. He concludes, however, that all of these bacteria possess the common property of having a specific effect upon the bloodvessels, causing molecular destruction either of the vessel walls or hyalin degeneration of the bloodvessels. Some of the results he also concludes are due to changes in the blood, and that the toxic products of bacteria are capable of producing not only the purpuric conditions, but can also cause excessive hemorrhages.

From the foregoing it is evident that certain micro-organisms, particularly those possessing the characteristics of the pneumococcus, are capable of provoking severe hemorrhages in various parts of the body, and that gastric and intestinal hemorrhage can be the first evidence of such a toxemia.

Occult Blood in the Diagnosis of Gastric Hemorrhage.

J. T. Strawn⁹ mentions a number of methods employed for the detection of occult blood and considers its significance in the diagnosis of gastric ulcer. He concludes as follows:

1. So long as a reliable blood test is used it does not make a great deal of difference which particular one is selected. But one should become thoroughly familiar with the technic and reading in the test used.

2. There are a great many possible sources for occult blood but by the help of prominent symptoms and signs, together with a complete physical examination, especially including the mouth, nose, throat, rectum and anus, the number is reduced in a practical sense in any one case to relatively few.

3. Accidental blood may be avoided by excluding meat from the diet and by passing the stomach-tube with care and watchfulness.

4. The positive test, unless exceedingly strong, as well

(9) Iowa Med. Jour., Dec. 15, 1911.

as the negative test, to be of the greatest value in the diagnosis of gastric ulcer should be made repeatedly. This is especially true of the stool.

5. Owing to the great number of peptic ulcers in which blood is not found either in the stomach contents or in the stool, one should not hesitate to make a diagnosis in the absence of the test. The stool may be used to confirm the diagnosis later.

6. The negative test speaks against ulcer only when mathematically considered in a probable diagnosis together with many other negative points. Still the negative test is important in differentiating it from carcinoma.

7. The positive occult test not only often serves to help build an almost unmistakable picture of ulcer but is of still more value as a differential diagnostic point.

Dorsal Tender Points. F. Seidel¹ inquires into the value of dorsal tender points as a sign of gastric ulcer and concludes from his own investigations of over 100 cases that the presence of these tender points is a reliable sign of gastric ulcer. The deeper and larger the ulcer, the more numerous, larger, and more tender the points are. They disappear gradually with the improvement and healing of the ulcer. The size of the tender point situated at the outer border of the vertebra varies from that of a pea to that of a two-shilling piece, and is very sharply limited from the surrounding tissues. The number of tender points is quite various, sometimes greater on one side, sometimes on the other, and sometimes equal on the two sides.

His investigations showed that the number and localization of the pressure-points stand in relation to the situation of the gastric ulcer. They may in this way furnish a basis for its localization. When the ulcer is situated at the pylorus the pressure-points on the right side are more pronounced; occasionally they are only to be recognized on the right side, and lie at the border of the tenth to the twelfth dorsal vertebræ and from the first to the third lumbar vertebræ. In ulcer of the posterior wall of the stomach the pressure-points reach as high as the cervical vertebræ so that the author has been

(1) Archiv f. Verdauungskr., Bd. 17, H. 6.

able to count on both sides as many as seventeen, and they are often more marked on the left side. In ulcer of the lesser curvature he found the pressure-points a continuous chain from the seventh dorsal vertebra to the third or fourth lumbar vertebra.

In the examination for pressure-points there is usually a marked contraction on the part of the patient. These reflex movements are shown by a series of muscular groups by the contraction of which an upward jerking movement of the body is caused. The head is bent forward, the forearms flexed, the recti abdominis and serratus muscles strongly contracted, and occasionally there is an associated catching respiration. In two of the author's cases hiccough occurred. To this symptom of reflex muscular contraction, Seidel applies the term "the contraction phenomenon of round gastric ulcer."

The examination for the dorsal pressure-point is best made in the following manner: The patient lies in a comfortable position, and the left hand of the physician, who is seated on the patient's right side, passes along the lower border of the twelfth rib to its attachment to the vertebra. There the middle finger exerts a gradually increasing pressure. With a definite but very various degree of pressure the reaction of pain suddenly begins which usually precedes the contraction phenomenon. Then the lower border of the epiphysis of the eleventh rib is palpated and so on until one reaches a place where no tenderness is exhibited. In the same way palpation is made from the twelfth rib downward to find the lumbar pressure-points which lie at a finger's breadth from the outer borders of the bodies of the vertebrae. In the same way the left side is palpated with the right hand. In cases in which the ulcer has penetrated the neighboring organs so that the disease is complicated by a perigastritis the tenderness increases to such an extent that a slight pressure on a narrowly circumscribed point gives rise to a very severe pain although the simple touch of the skin is entirely painless.

In neuroses of the stomach and gastropareses which exhibited a symptom-complex of great similarity to that of ulcer of the stomach Seidel was never able to find the pressure-points which have been noticed. He calls atten-

tion, however, to the fact that the common hyperalgesia so frequently found in nervous individuals must not be confounded with the deep-lying pressure-points which are characteristic of ulcer of the stomach.

Ulcer of the Anterior Wall. A. Bassler² reports a case of acute gastric ulcer of the anterior wall. The patient entered the hospital complaining of pain which was relieved to a moderate degree by the taking of food, more so by bicarbonate of sodium, and was entirely relieved when the patient lay flat on her back with her corsets off. The stomach contents showed free hydrochloric acid 55, combined 28, and a total acidity of 87. A small amount of macroscopic blood was present with one small clot. The feces voided the day before and two days afterward showed the presence of occult blood. Radiography showed that the organ was large and low and that the ulcer bed was lined with bismuth. When the *x-ray* plates were held against the patient's body and the ensiform and umbilical markers on the plates matched to these parts on her body, the location of the ulcer noted on the plate corresponded exactly to the point of tenderness and the plastic exudate. The treatment consisted in the administration of alkaline powders, movement of the bowels by a castile soap enema, an icebag at first to decrease the tenderness at the site of the ulcer, and iron to combat the anemia.

Recovery was perfect and the patient left the hospital with an increase of weight from 98 pounds on entrance to 127 at the end of two months. The ulcer could no longer be demonstrated by the *x-ray*, the stomach was smaller in capacity, the test-meals were normal, and the feces free from blood.

Diagnosis. J. B. Deaver,³ in discussing the relative obscure conditions in ulcer about the pylorus, emphasizes the fact that ulcer is more frequently situated in the duodenum than in the stomach. The frequency of remissions is also noted. It is necessary to hold clearly in mind that a duodenal ulcer may exist without pain, vomiting, hemorrhage, perforation, or obstruction of the pylorus. One patient bleeds and has no pain. Another suffers intensely from pain and never bleeds. A third

(2) Jour. Amer. Med. Assoc., July 22, 1911.
(3) Long Island Med. Jour., March, 1911.

case perforates, and until the day of perforation has no pain or bleeding. Still another has pain and bleeding but never vomits. Finally, there is a case that has all the symptoms and it is evident that the converse must be true, that there must be cases which have no symptoms, except negligible dyspepsia, and which heal naturally and completely.

The treatment of chronic duodenal and gastric ulcers is surgical and an exact procedure must be determined from the condition of the patient in general and the local condition exposed at operation.

[Most clinicians and thoughtful surgeons will not agree that all, even most, chronic duodenal ulcers should be treated surgically, in the light of the present knowledge of the disease.—B.]

Nervous Complications. Klippel and Weil⁴ call attention to the importance of polyneuritis complicating ulcer of the stomach. This condition has for a long time escaped the observation of clinicians, and the authors believe themselves to be the first to draw attention to this complication. Other authors have since reported a number of similar cases. They sum up the symptoms presented by three cases as follows: All three suffered constant pain in the stomach of a more or less paroxysmal character and elicited by pressure. The pains were accompanied by vomiting of food and by frequent and abundant hematemesis. It seems evident that in these three cases one might diagnose with certainty an ulcer of the stomach. On the other hand, all three presented on the part of the limbs an affection of motility, sensation and reflex action which in two cases arose subsequently to the gastric trouble. These affections were characterized by paresis, affecting the four limbs, accompanied by loss of the tendonous and cutaneous reflexes and by subjective and objective disturbances of sensation. Palpation of the nerves and of the muscular masses was more or less painful. The paraplegia was of a flaccid character, indicating a polyneuritis. There were no signs of tabes. The cause was probably to be referred to toxic or infectious substances absorbed from the ulcer of the stomach.

Polyneuritis from gastric ulcer may sometimes simulate tabes so that the clinician may hesitate between a tabes complicated with gastric crises and an ulcer of the stomach complicated by pseudotabetic polyneuritis. The authors report such a case.

The recognition of a pseudotabetic polyneuritis connected with ulcer of the stomach is of practical importance. A clinical form of tabetic gastric crisis has been described, characterized by hematemesis. Without denying the possibility of such cases the authors believe that the possibility of a gastric ulcer complicated by polyneuritis should always be taken into consideration.

Treatment. *Diet.* W. J. Mallory⁵ calls attention to the underlying principles which should govern the selection of a diet for gastric ulcer and which are applied in all diets advocated notwithstanding the lack of agreement as to details. All food should be given in a finely divided form in order to avoid unnecessary mechanical action and possible injury to the ulcerated surface. It should tend to reduce the acidity rather than increase it. The objection to protein, that it is a natural stimulus to the secretion of hydrochloric acid, applies merely to meat. In fact it is of more importance in what form the food is given and particularly as to what variety of protein is used. The diet should be of high caloric value and not bulky, and in order to avoid distention it should be given in small quantities and frequently repeated. Little salt should be used in the preparation of the food or at table. The medical treatment is directed to reducing the acidity, relieving pain and pyloric spasm, and possibly toward exerting some direct influence on the ulcer itself. These indications are met chiefly by the use of alkalies, belladonna, and nitrate of silver.

Rectal Feeding. J. Dudley-Dunham⁶ reaches the following conclusions from investigations of the possibilities of rectal alimentation in the treatment of diseases of the stomach:

1. Albuminous substances are absorbed from the lower bowels to such a slight extent that they do not seem to be practically suitable as material for use in rectal nutrition.

(5) Jour. Amer. Med. Assoc., Nov. 4, 1911.

(6) Archiv f. Verdauungskr., Bd. 17, H. 6.

2. On the other hand, sugar and fat are readily absorbed. A good nutrient enema consists of the yolks of two eggs (300 calories), 30 gm. of pure grape sugar (420 calories), 5 gm. of common salt, and pancreatized milk to make 300 c.c.

[It has been proved experimentally and clinically that fat is not absorbed from the rectum and colon.—B.]

3. Rectal alimentation cannot replace nourishment by the mouth for any length of time because emaciation will be the result. For this reason the value of rectal alimentation is restricted in its scope, and is not to be recommended in cases of stenosis of the esophagus or pylorus.

4. High enemata of physiologic salt solution are to all appearances as useful as the ordinary nutrient enemata.

5. Applied in the case of uncomplicated ulcers nutrient enemata do not raise the acidity of the gastric juice. On the other hand, in combination with complete abstinence from solid and liquid food the acid of the stomach is probably decreased. In gastric ulcers with relative stenosis of the pylorus gastric lavage and carefully selected nourishment *per os* are to be preferred to nutrient enemata.

Limitations of Surgery. C. D. Aaron⁷ reviews the stomach disorders with reference to the necessity of surgical intervention. A simple, uncomplicated gastric ulcer does not demand surgical intervention. Only in the event of complications and in the event of the ulcer defying thorough internal treatment, and impairing nutrition by interference with motility, should there be any question of surgical intervention. The fact should always be taken into consideration that in the present state of the science of diagnosis we can have only a suspicion as to the seat of the ulcer. We know that four-fifths of all gastric ulcers are situated at the lesser curvature on the posterior wall of the stomach—a surgically inaccessible place. Unless, therefore, there is a well-developed ulcer of the pylorus, which has been diagnosed by the presence of retention, it is impossible to make a safe prognosis of recovery or even of improvement through surgical intervention.

W. J. Mayo says that “nearly all the failures of sur-

gery for ulcer of the stomach are to be found in the group of so-called clinical or medical ulcers because: (1) The ulcer is not found and many times its existence is problematic; (2) the condition is often confounded with pyloric spasm, atonic dilatation, gastropotosis, gastric neuroses, or other morbid and non-surgical conditions; (3) simple ulcer does not give rise to that mechanical interference with the progress of food which would introduce an operative indication." Internists owe a debt of gratitude to this surgeon who has had the courage to come out and tell us plainly that it is the duty of internists to bring about a recovery in simple and uncomplicated cases of gastric ulcer.

So far as surgery is available, no procedure but the removal of the ulcer by excision or gastro-enterostomy is to be considered. Removal of the ulcer does not remove the cause nor the tendency to new formation, nor does it improve motility, nor reduce superacidity; but it does remove the dangers accompanying the ulcer, such as hemorrhage, perforation, and malignant degeneration. Gastro-enterostomy and favorable drainage protect the ulcer from irritation of the superacid gastric contents, and some ulcers which have defied every kind of therapy will sometimes heal or become latent after gastro-enterostomy. Ulcer of the pylorus or duodenum can be cured by gastro-enterostomy, but this operation will not cure ulcers in other parts of the stomach.

[Chronic ulcer in any part of the stomach or duodenum which does not interfere with the motor function should receive medical management, of the *best and most rational kind*, for a period of time sufficient to prove the possibility of cure by that means. Only those who suffer with an ulcer which interferes with the motility of the stomach and its normal power to empty itself by reason of scar formation, perigastric and periduodenal adhesions, or other anatomic lesions which partially close the pylorus or deform the stomach, should be operated by gastro-enterostomy. Intractable hemorrhage and perforation are always surgical conditions. Gastro-enterostomy for simple chronic ulcer with a functioning pylorus is inexcusable.—B.]

It is always necessary to pay special attention to the

diet after gastric operations in order to achieve the most favorable results. It is certainly surprising to observe that a patient compelled for years to live on milk and soups, is allowed at once to partake of roast beef and potatoes. It is an overestimation of surgical effect to suppose that a stomach which has been seriously impaired for a number of years can suddenly develop normal function. It is irrational to allow such a patient to get out of bed after two weeks and to discharge him as cured at the end of three weeks. After the operation a careful dietary should be instituted for weeks and even months if necessary. The surgeons should be assisted in the care of such convalescents by an internist trained for this purpose. This course, together with the simultaneous use of alkalies, constitute the best method of avoiding the danger of new formations, especially of ulcer of the jejunum, in which location an ulcer is apt to come as a sequel of gastro-enterostomy.

One of the most frequent complications of gastric ulcer is hemorrhage. Acute hemorrhage is not a condition that lends itself to surgical treatment. Such hemorrhages can usually be stopped by internal treatment, but if this should fail, operative intervention is not likely to help. Less than 5 per cent. die of these hemorrhages without operation. By subjecting patients to operation, we expose them to further dangers to which they easily succumb, while without operation they have a better chance to recover. This view is shared by a large number of experienced surgeons. As a matter of fact few cases of gastric hemorrhages have been lost when proper therapeutic measures were instituted. With internal treatment Lenhartz reports 201 cases of gastric hemorrhage with a mortality of 3 per cent., Ewald 166 cases with a mortality of 4.8 per cent., and Wrisberg reports 320 cases with a mortality of 5.9 per cent. Robson, resorting to operative treatment in 45 cases of acute hemorrhage, saved 15; without operation he would probably have saved 40. The ligation of the coronary arteries which supply the ulcer is not to be endorsed, because the results achieved without surgical intervention are better.

What is our position as to the treatment of ulcers,

which, characterized by chronic oozing of blood, lead to grave anemia? If energetic internal treatment should not be successful, as can easily be observed by daily examination of the feces with the benzidin test for occult blood, operative treatment should be advised. Either resection of the ulcer or, where this is impossible, gastro-enterostomy should be done. The latter operation frequently stops the hemorrhage, especially if the ulcer is situated at the pylorus. In the case of pyloric ulcer it is not the hemorrhage but the stenosis which renders operation necessary.

In cases which do not improve after a prolonged course of internal treatment and in which pyloric obstruction is not present, it is unwise to promise a recovery by a gastro-enterostomy. Surgeons agree that good results in ulcer of the stomach by gastro-enterostomy are obtained only when there is a pyloric obstruction. Gastro-enterostomy does not give drainage and physiologic rest when the pylorus is patulous. Cannon and Murphy have shown that food and liquids pass through the pylorus even after gastro-enterostomy has been performed. The artificial opening does not help matters so long as the pylorus is unobstructed.

Another dangerous complication of gastric ulcer is perforation into the free abdominal cavity, followed by peritonitis or a subphrenic abscess. This complication requires surgical intervention, and the operation should take place within ten hours after perforation, when the mortality is about 28 per cent. According to figures, the mortality rises to 65 per cent. if the operation is delayed for more than twenty-four hours, and to 87 per cent. after thirty-six hours; undertaken later, operation offers no hope. The operation may be very simple for perforation at the greater and lesser curvatures and at the anterior wall of the stomach. If the perforation has taken place at the posterior wall the operation is most difficult and usually does not do any good. Statistics in perforation show such unfavorable results by internal treatment that it seems imperative to resort at once to surgery, unless there are very important factors to contra-indicate it.

Subphrenic abscess following perforation should likewise be operated on as soon as possible.

The surgically most important complication of gastric ulcer is benign pyloric stenosis with subsequent dilatation of the stomach.

From a consideration of the value of medical and surgical treatment of gastric and duodenal ulcer C. R. Jones⁸ notes that a more conservative stand is taken by gastro-enterologists with reference to the advisability of operation than was the case four years ago. The complications for which operations on the stomach are undertaken have been narrowed down by most surgeons. The indications for operating are large hemorrhages occurring at intervals of some months; continuous small hemorrhages resisting long-continued, consistent, medical treatment; stenosis; perforation; and symptoms of ulcer with the presence of a mass located in any part of the stomach or duodenum. Jones concludes: 1. Simple gastric and duodenal ulcers require only medical treatment. 2. Complications sometimes require surgical interference. 3. When surgery is necessary it is only an incident in the treatment and must be supplemented by careful dietary and medical treatment.

PYLORIC STENOSIS.

Instrumental Dilatation. M. Einhorn⁹ describes his instruments for stretching the pylorus in the benign stenosis of infants. (See Figs. 12 and 13.) His method of aspiration is as follows: The infant is given one of the duodenal olives attached to a silk thread (about 25 inches long), either the night previous to the stretching or about six hours ahead. Three to four hours after the last feeding, the stretching, provided the olive has reached the duodenum, is performed as follows:

The fastened thread is cut off near its outer end and pulled through the eye of the dilating catheter. The latter is pushed with the right hand into the mouth, esophagus, and stomach along the thread, which is held securely by the left hand. This procedure must be per-

(8) Amer. Jour. Gastro-Enterology, April, 1912.

(9) Med. Record, June 10, 1911.

formed gently. The catheter is then pushed still further until a resistance is encountered which cannot be overcome (this generally occurs at the angle of the duodenum, "ramus horizontalis"). At this point the balloon of the catheter is filled up with air by means of a syringe. The instrument is then drawn somewhat for-

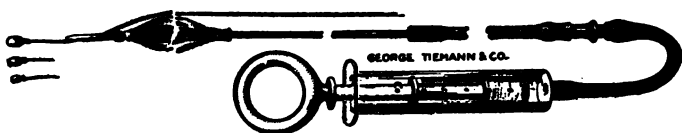


Fig. 12.—The infantile pyloric dilating catheter, with infantile duodenal olives.

ward until it meets with the pyloric resistance. Here it is slightly deflated, so that the balloon can pass the pylorus by a gentle pull. After reaching the stomach there is no resistance felt when withdrawing the instrument until meeting the cardia. The balloon is now completely deflated and the instrument as well as the olive

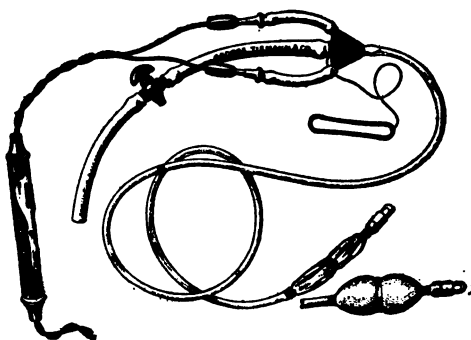


Fig. 13.—The pyloric dilator and diaphane.

and the thread are withdrawn. By noting the points at which the catheter met the two resistances (pylorus and cardia) the exact distances of these two orifices can be calculated.

The author reports two cases in which this method was successfully applied. He believes that it should be

adopted whenever a congenital stenosis of the pylorus is found, no matter whether due to mere pyloric spasm or to a real stenosis. The stretching can be done either by the infantile pyloric dilator (resembling the pyloric dilator for grown persons only much smaller) or by the infantile inflatable dilating pyloric catheter. (See Fig. 12.) The latter instrument has mainly been used in infants.

Etiology. M. Gross¹ enumerates the following affections as possible causes of benign stenosis of the pylorus and duodenum:

1. Tumors, which may narrow the lumen of the pylorus from without (pancreas, gall-bladder, etc.)

2. Adhesions around the pylorus, which may occasionally interfere with its function, but may also lead to kinking and distortion of the entire pyloric part.

3. Angulation (kinking) of the normal duodenum at the peritoneal point of fixation, at the *pars superior duodeni*.

4. Hypertrophy of the pylorus may cause stenosis.

5. Spasms of the pyloric muscle may be the cause of stenotic manifestations.

6. Florid ulcers, surrounded by strong, prominent induration, may be the cause of pyloric stenosis, as may also cicatricial cords developing after the ulcer has healed.

7. Manifestations of stagnation may likewise be caused by duodenal stenosis, occasioned by low position of ulcers and cicatrices, by gall-stones protruding into and becoming wedged in the duodenum, by the rare cases of stenosis of the duodeno-jejunal ring and, finally, by pressure of the root of a heavy and deeply descended mesentery upon the *pars inferior duodeni* (Codman).

Duodenal and pyloric stenoses are difficult to differentiate clinically. Gross finds it possible with the aid of his duodenal tube not only to state whether there is a pyloric or duodenal obstacle but also to localize it, and in suitable cases to gain information concerning the nature of the stenosis. Gross reports three cases.

(1) N. Y. Med. Jour., Aug. 26, 1911.

HOUR-GLASS STOMACH.

Differentiation between Benignant and Malignant Hour-glass Stomach. Kretschmer² concludes a discussion of the differential diagnosis between malignant and benignant hour-glass stomach as follows: In malignant hour-glass contraction the organ is separated into a horizontal and a vertical portion by more or less horizontal indentation. A more important distinction is the peculiarity of the benign form in that the upper sac empties into the lower, while in the malignant form both parts fill equally, but first the one which has the deepest point.

CARCINOMA OF THE STOMACH.

Diagnosis. J. W. Weinstein³ summarizes as follows the indications of carcinoma presented by the clinical history: The cancer history is characterized by a sudden abrupt invasion of a serious disease in a formerly healthy individual of cancerous age, the duration of the disease dating back a few weeks or months only; acute, sudden, complete loss of appetite; steady, progressive non-remittent loss of flesh and strength; steady, progressive anemia. Whenever an adult presents himself with this history, with or without any of the symptoms enumerated under the secondary group (vomiting, especially of coffee-ground material, aversion to meat, pain in the stomach), cancer of the stomach should be suspected, and further evidence should be looked for. This evidence, for or against it, will be found in the physical examination of the patient and the various laboratory methods. It should be borne in mind that the cancer history is never volunteered to us by the patient, but we have got to get it out by careful and painstaking cross-examination.

Evidence of the Test-Meal. The test-meal should be examined macroscopically, microscopically and chemically. If a test-meal consists of a white, milky emulsion, all the particles being of about the same size, the contents separating into two layers, one of solids at the bottom and the other a watery liquid at the top, the patient has not cancer of the stomach even in the face of

(2) Berlin. klin. Wochenschr., July 17, 1911.

(3) Interstate Med. Jour., March, 1912.

a cancer history. He may have a cancer in another organ, but not in the stomach. On the other hand, if we find the stomach contents to be dark, like coffee-grounds, or grey, which on making a chemical test, such as the guaiac or benzidin, is proved to be blood, and if there is no free hydrochloric acid in the contents, the diagnosis of cancer of the stomach is almost made.

Sarcinæ ventriculi are often met with where the carcinoma invades the pyloric region. They are an unmistakable sign of pyloric obstruction, benign or malignant. It was believed at one time, that *sarcinæ* always meant a benign stenosis. In fact, Oppler injected pure cultures of *sarcinæ ventriculi* into a carcinomatous stomach, and in twenty-four hours all the *sarcinæ* disappeared. The writer also believed in this doctrine. During the last two years, however, he has seen several unmistakable cases of cancer showing *sarcinæ*. The condition, as he found out later, that determines the presence or absence of *sarcinæ* in pyloric obstruction, is not malignancy or benignity, but the presence or absence of free hydrochloric acid. *Sarcinæ* do not thrive in an anacid medium. They are therefore present in those cases of pyloric obstruction that show free hydrochloric acid and absent where there is no free hydrochloric acid. The writer saw, however, a few months ago one case of pyloric obstruction without free hydrochloric acid, and still *sarcinæ* were present.

Oppler-Boas bacilli are seldom found in the early stages of cancer and never in case free hydrochloric acid is present.

Differential Diagnosis of Malignant and Benign Pyloric Obstruction. In benign pyloric obstruction the course of the disease is a much slower one than in malignant obstruction. The writer saw patients go on with benign pyloric obstruction for a good many years. In cancer the history is only of short duration, a few months. If a patient with a history of long-standing pyloric obstruction starts suddenly to lose strength with great rapidity, we must think of malignant degeneration. In benign obstructions we often get a history of previous pyloric or duodenal ulcer. Loss of flesh and strength is of no value in differentiation, for it is present

in both. Given a pyloric obstruction without any free hydrochloric acid, it is undoubtedly cancerous. The presence of Oppler-Boas bacilli means malignancy.

A variety of newer methods came into vogue of late to diagnose cancer of the stomach in its early stages. To these belong the Solomon test; the hemolytic test; Ascoli's meiotagmin reaction; the tryptophan test. With the exception of the tryptophan test, the writer considers the others of not very much value, for they are very difficult of execution and, after all the hard work, there is nothing conclusive in them. Weinstein tests for tryptophan directly and considers the method a good diagnostic aid, but it is fallacious unless one is certain that intestinal contents have not regurgitated into the stomach.

The *x*-ray and gastroscope are of minor importance. Janeway and Green have reported lately some good work in gastroscopy. They examined 14 cancers of the stomach. Of these they missed only 2, and these were situated in the pyloric region. In 6 out of 10 cases that involved the cardiac part of the stomach, they succeeded in removing through the gastroscope bits of tumor, and proved them by microscopic examination to be carcinomatous.

Early and Late Diagnosis of Carcinoma of the Stomach. I. Boas⁴ calls attention to the fact that authors have commonly misinterpreted the meaning of an early diagnosis of cancer of the stomach. This is shown by the varying definitions given for an early diagnosis. Some authorities hold that any diagnosis is to be considered early if no palpable tumor is present, but this is quite fallacious, since a very extensive carcinoma of the stomach may exist without producing a palpable tumor. Again, the diagnosis of carcinoma within a short time after the appearance of symptoms is held to be an early diagnosis. This is also misleading, because it is very common to observe a very rapid and extensive development of carcinoma in a short time after the first appearance of symptoms. These mistakes are due to the failure of authors to recognize the difference between a diagnosis of the existence of cancer and a diagnosis of

(4) Deutsche med. Wochenschr., Dec. 7, 1911.

its early stage. Many of the symptoms relied on for the diagnosis of cancer indicate simply the presence of the neoplasm, but present no criterion as to whether the disease is in a very early stage or is already far advanced. For the diagnosis of the early stage of carcinoma all of the methods so far advanced are failures. A suitable and convincing evidence to determine this question can be furnished in Boas' opinion only by a biopsy, an autopsy *in vivo*.

While it is scarcely practicable to define satisfactorily what is meant by an early diagnosis, the author believes that the opposite problem, that is, the diagnosis of the late stage, which has been heretofore almost totally neglected, should receive greater attention as being of more practical worth. In contrast to the early diagnosis the late diagnosis signifies that stage of development in which the only methods of treatment heretofore known must be regarded as completely hopeless. The practical value of this late diagnosis depends essentially on the fact that it furnishes us the criteria for recognizing the inoperable cases as clearly and as sharply as possible. The author concludes as follows:

1. As criteria of a genuine early diagnosis of cancer of the stomach we can admit only the bioptic discovery of a cancer in its earliest stages, or still better, the fact that by means of this early diagnosis we are able to secure a considerable improvement as the immediate result of the operation, and a decided success in treatment.

2. All the symptoms so far proposed as of early diagnostic value fail to answer this requirement in any way.

3. Instead of hunting for the hitherto impossible requirements of early diagnosis, it appears to be of more practical importance and also more within our reach to improve and make more accurate our knowledge of the symptoms indicating a late stage so that we may be in a position in most cases to distinguish the early cases from the late ones before the laparotomy. Already we possess for this purpose a number of decided signs which should, however, be considerably increased in the future.

4. An exact knowledge of the late symptoms of carci-

noma is of great importance for surgical practice and may essentially contribute to a diminution of the number of unsatisfactory exploratory laparotomies.

Gastric Peristalsis in the Diagnosis of Cancer. G. E. Pfahler⁵ places considerable value on the state of gastric peristalsis as an aid to the diagnosis of disease of the stomach. Cancer of the stomach usually occurs at the pyloric end of the stomach where the peristaltic waves are strongest, and in advanced cases the peristaltic wave stops completely at the site of the tumor. Much or all of the lumen of this portion of the stomach is also found obliterated, and characteristic, irregular, serrated margins will be noticed. At times the wave can be followed to the carcinoma, becomes obliterated, and then begins again on the opposite side. In pyloric stenosis the waves are usually deep and frequent while they last. Reversed peristalsis is sometimes observed in pyloric obstruction. Gastric ulcer may cause tetanic or spasmodic contractions which may last an indefinite time. Secondary gastric adhesions will also interfere with the peristaltic wave. Gastric atony may give general absence of the peristaltic wave, or one may have to excite the wave by external manipulation. In these cases very strong waves are likely to occur at long intervals. Pfahler concludes as follows:

1. Cinematographic reproduction of the peristaltic wave of the stomach is at present possible by reducing and repeating separate exposures at comparatively long intervals.

2. Bio-Röntgenography is at present of great value in demonstrating to an audience both normal and pathologic movements of the stomach.

3. In the near future we may hope to record cinematographically (ten or more exposures in a second) special phases during the study of a stomach upon the fluorescent screen. This may then make it of additional value in diagnosis, since the photographic plate is more sensitive than the eye.

4. A careful study of the peristaltic wave will give the earliest evidence obtainable of carcinoma of the stomach.

(5) N. Y. Med. Jour., May 6, 1911.

Treatment. Radium Therapy. M. Einhorn⁶ reports his experience with the radium treatment of cancer of the digestive tract. The diagnosis of early malignancy is not always possible in the digestive tract. Frequently operation is impracticable. For these cases the radium treatment appears to have a great future. In cancer of the esophagus Einhorn obtained good palliative results; the strictures became less narrow and the patient could take food and lead an endurable existence.

Since radium must be applied for some length of time, it is important to construct the instrument in such a manner that it shall not annoy the patient. The radium-holder with whalebone stem is simple to handle and its application not disagreeable to the patient. The instrument is suitable for the treatment of cancer of the esophagus and stomach. Whereas, however, in the esophagus the radium can easily be applied at the desired spot,



Fig. 14.—Radium introducer and radium receptacle for pylorus with whalebone stem.

thus exerting a powerful action upon the part affected, this cannot be accomplished in cancer of the stomach. Here the radium cannot be applied always in the most effective manner. If the cancer is at the pylorus, it causes grave early symptoms through narrowing of the canal and limitation of the food supply. If, as in the esophagus, we could apply the radium exactly to the affected spot, the therapeutic result would be considerable. It could then be hoped that in favorable cases the strictured pylorus might become more permeable.

Einhorn constructed for this purpose an instrument for the application of radium to the pylorus. It consists of a radium receptacle with a long whalebone stem; the capsule for the reception of the radium is provided with a small canal on its side, through which a thread can easily be passed (see Fig. 14). The method of radium

application to the pylorus is accomplished in the same manner, as described for the catheterization of the pylorus. The patient swallows, the night previous, either a small duodenal bucket or a metal olive, attached to a long braided silk thread; the length of the thread is such that 75 to 80 cm. can enter the digestive tract and the end is attached to the shirt. On the following morning, in the fasting condition of the patient, we see whether the bucket or the olive lies beyond the pylorus or in it. If this is the case a slight resistance is felt when we pull at the thread. In the stomach there is usually no such resistance felt. The thread is now cut near its-attachment and drawn through the canal of the capsule and the latter is pushed along the thread by means of the whalebone stem, first into the mouth, pharynx, esophagus, and finally the stomach of the patient, slowly and without exertion of force; until an unsurmountable resistance is encountered. The latter is the strictured place. The capsule of the instrument now lies exactly at the spot we wish to treat with the radium. We, therefore, let the instrument lie there for one-half to one hour, after again attaching the thread to the nightgown of the patient. When the time for the application of the radium has elapsed, the radium-holder, the olive, and the thread are slowly withdrawn.

Einhorn has also constructed a "radium-introducer." It consists of a spiral metal sound, covered with rubber, and a mandril. For a longer application of radium we use a capsule hollowed out in its upper end. The introducer is inserted into the hollow part of the capsule, the thread is drawn tight and pressed against the rubber tube. In this position the capsule is pushed to where it is wanted (esophagus or stomach). Now the mandril is first removed. This causes the capsule to lie free. Then the rubber tube of the introducer is slowly and carefully removed. We now have the capsule with the radium at the seat of the disease, and the thread emerging from the mouth of the patient is attached to the clothing. This procedure is not connected with any disagreeable symptoms for the patient, and the capsule can be retained in the digestive tract as long as desirable.

Latest Experiences in the Radium Treatment of Can-

cer of the Digestive Tract. Einhorn describes two new cancer cases of the esophagus, in which the new instruments were used. He also reports four cases of carcinoma of the stomach and one affecting the rectum. Applications of 0.07 gm. of pure radium bromid for periods of 6 hours caused no disturbances and were followed by good results.

Of the four cases of cancer of the stomach and pylorus, in one case a gastro-enterostomy without the removal of the tumor had been performed six months previously. The only symptom (steady vomiting), however, had returned. There was grave isochymia, and blood was easily recognized in the stomach contents. After the use of radium the vomiting ceased, retention was less, and blood was no longer present. The tumor, however, did not decrease in size. In the other 3 cases there was a marked diminution of the bleeding into the stomach. In two there was first a marked improvement with some gain in weight. In one, where the applications took place directly to the pylorus, the latter became for a short time more permeable. A decrease of the pains was apparently present in all of these cases. In an advanced case of cancer of the rectum, the application of radium caused a cessation of the bleeding and pain, and undoubtedly prolonged life.

GASTRIC SYPHILIS.

A. Mathieu⁷ divides gastric syphilis into the following groups from a clinical standpoint:

1. Chronic disease of the stomach without tumor and without pyloric stenosis with the clinical picture of grave chronic gastritis.

2. Malignant disease of the stomach with puffiness or tumor simulating cancer of the stomach without pyloric stenosis.

3. Syphilitic disease of the stomach with pyloric stenosis, simulating primary neoplastic stenosis of the pylorus.

4. Syphilis of the stomach in the form of ulcer.

5. Syphilis of the stomach distinguished especially

by malformations of the stomach in the form of hour-glass contraction.

In 1838 Andral reported two cases belonging to the first class. The first case was that of a woman, 27 years of age, who had had no symptoms which might lead one to suspect syphilis except several small pimples on her lips which had yielded to simple treatment. The clinical picture indicated a chronic gastritis but the ordinary treatment made no impression and the disease grew worse. Four months after the onset she was attacked with vomiting. At this time she complained of her throat and examination revealed a specific ulcer which suggested that syphilis might be the cause of the stomach lesion. Mercuric chlorid was given in progressive doses and after fifteen days improvement was noticeable, vomiting became less frequent, the digestion better, and she became stronger. At the end of one month improvement was marked and mercurial friction was given in addition to the mercuric bichlorid. After the twelfth friction, symptoms had practically disappeared and the patient was soon in good health.

In certain cases of the second class there is no protruding tumor but a puffiness, a diffuse induration resembling in all other particulars a case of epithelial neoplasm of the stomach. The author cites an unpublished case.

A third form of gastric syphilis shows pyloric stenosis identical with primary pyloric stenosis of cancerous origin.

Hayem published a very curious observation in the *Presse Médicale* in 1905. A country gentleman, 60 years of age, showed symptoms of marked dilatation of the stomach with early morning stasis and vomiting of food of the previous day, loss of appetite, emaciation and tendency to cachexia. These symptoms and the presence of a marked hypochlorhydria and the total absence of free hydrochloric acid suggested a neoplastic lesion and pylorotomy was performed. It was not until after histologic examination of the resected tumor that the diagnosis was established.

Adhesions often exist at the same time as the gummatous infiltrations; moreover, cicatricial retractions are

produced which may lead not only to peripheral fixation of the stomach but to more noticeable malformations, and it is not strange to find in such a case a biloculation. Mathieu reports such a case in which a man had marked gastropathic crises probably due to ulcerous growth. After an extended period of treatment he complained of slow pain, sudden vomiting and emaciation. Radioscopic examination with the administration of lactate of bismuth showed a pocket situated a little to the left of the median line which first filled, and after several minutes a second pocket could be traced on the opposite side of the median line at the edge of the liver, finally resembling an oblique cylinder situated at the right directly under the liver. This second pocket remained uniform in different examinations and gave the appearance of a rigid, inflexible cavity. The bismuth might be seen passing from the upper to the lower pocket at the level of their union at an obtuse angle. The two pockets united presented the appearance of a horn bent and inflated at the neck. The patient was about to be operated on when syphilitic treatment was suggested and instituted. The relief was marked and rapid; the pain disappeared, and the general condition of the patient was relieved. The difference between the two pockets tended to diminish, and in the last examination it was difficult to find a trace of biloculation of the horn, the angle which joined the round and bent part having disappeared.

The lesions are characterized by gummatous infiltrations. There is a tendency to sclerotic formation, and there are fibrous masses at the periphery of the gummatous masses. When the gummatous masses disappear the fibrous tissue remains stubborn to all kinds of therapy; these are the incurable lesions.

Certain peculiarities of the development of the disease of the stomach may also attract attention. In the form resembling cancer of the stomach it may very often be seen that cachectic appearances are less clear, less rapid, and the development is slow; however, it is known that there are scirrhus forms of cancer of the stomach which also develop very slowly when pyloric stenosis is not present,

The Wassermann reaction is a valuable diagnostic means which should be employed without fail. The true test, however, is the effect of treatment. Most cases improve rapidly, generally showing a marked change at the end of two or three weeks.

Treatment should take the form of subcutaneous, intramuscular or soluble injections which Mathieu prefers, especially those of iodid of mercury. While simple and cancerous ulcers are aggravated by potassium iodid, iodin medication is well borne in syphilitic disease of the stomach. The general and gastric symptoms are relieved rapidly. When there are no irreparable sclerotic lesions the patient reacts and in cases of specific visceral lesions good results may be obtained.

DUODENAL ULCER.

Diagnosis. According to G. Herschell ⁸ a typical history is of great importance in the diagnosis of duodenal ulcer. In most cases it will be found that the patient has for a considerable time, frequently for many years, suffered from successive attacks which, although varying in severity, have the same general characteristics. These usually come on in the spring and autumn and seem to follow exposure, overfatigue, mental worry, or ingestion of indigestible food.

Pain is present, varying in intensity from a mere feeling of discomfort to a burning, gnawing sensation, being occasionally severe and cramp-like or resembling colic. The pain is usually felt in the epigastrium to the right of the median line, and in advanced cases may radiate to the back or toward the right shoulder, being reflected through the third and fourth dorsal nerves. Pain occurring shortly before meals and which is promptly relieved by food, called "hunger pain," is a valuable but not a diagnostic sign.

While heart-burn is often met with in duodenal ulcer it is not of diagnostic value. In a certain number of cases flatulence coming on after meals and especially at night is the only subjective sign of ulcer. Salivation is a reflex phenomenon and when present is very suggestive of the disease. Hemorrhage is a valuable symptom and

(8) Interstate Med. Jour., March, 1911.

even justifies a diagnosis in the absence of some of the characteristic symptoms. A certain degree of dilatation of the stomach is often met with. The right rectus muscle shows distinct rigidity in most cases. Tenderness is common but is absent in more than half the cases.

Herschell places more importance on the finding of certain physical signs than Moynihan. He believes that the presence of staphylococci, leukocytes or red corpuscles in the fluid duodenal contents points to organic disease. Any clinical sign which shows the presence of a definite lesion in the duodenum is a diagnostic aid.

Duodenal ulcer must be distinguished from the following affections: (a) Duodenal ulcer is often diagnosed as gastric neurasthenia. (b) Care should be taken to distinguish duodenal ulcer from pyloric spasm due to reflex irritation. (c) Recurring attacks of regional peritonitis common in long-standing duodenal ulcer may resemble gall-stone colic, but a stone impacted in the cystic duct with a contracted gall-bladder may also produce symptoms resembling those of duodenal ulcer.

Pain as a Diagnostic Sign. L. Meunier⁹ criticizes the diagnosis of duodenal ulcer made by English and American clinicians on the basis of pain occurring late after eating, and suggests that if this were made the rule for operation it would be necessary to advise gastro-enterostomy in about 80 per cent. of patients who consult the physician for an affection of the stomach. He believes that this is unwarrantable, and is of the opinion that the diagnosis of ulcer should not be made unless it is possible to demonstrate a hemorrhage, however minute. This in conjunction with the existence of late pains, justifies the diagnosis of ulcer. The question then arises what is the situation of the ulcer? Is it in the body of the stomach, in which case it is possible to pursue a medical treatment, or is it in the duodenopyloric region, which necessitates a recourse to surgery? In order to answer this question he employs a procedure based on the following principles: If we wash the stomach of the patient with a weak (1-per-cent.) solution of glacial acetic acid two phenomena are produced:

Under the influence of the acid the pyloric sphincter

contracts, closes the cavity of the stomach and shuts off the wash-water from the duodenum in the neighborhood of the pylorus where a duodenal pyloric ulcer is almost exclusively situated.

On the other hand, an ulcer of the body of the stomach is found in contact with the acid solution. Crystals of hematin which always exist on the surface of a relatively fresh wound dissolve in the acetic acid solution and are easily demonstrated by chemical means. The result of this simple manipulation is that a positive reaction for blood in the wash-water indicates an ulceration of the body of the stomach, and a negative reaction is evidence of an ulceration of the duodeno-pyloric region.

The technic is very simple. The stomach should be washed some hours before the test in order to make sure of the empty state of the organ. Then lavage should be made with the 200 c.c. of water containing 2 c.c. of glacial acetic acid. A few c.c. of this wash water are put in a test-tube and an equal volume of solution of hydrogen dioxid and of an alcoholic solution of 1-per-cent. benzidin are added to it. The benzidin should be freshly prepared when needed. In the presence of traces of hematin the liquid gradually assumes a green color which passes into a bluish green. The author has tried this method in patients who had had intestinal hemorrhages of a more or less slight degree. All had suffered with paroxysmal delayed pains after meals which according to the Anglo-American surgeons would have justified the diagnosis of ulcer of the duodenum.

1. The patients in whom the acetic acid reaction was positive were operated on by M. Routier. The operation showed lesions affecting the body of the stomach. 2. In two patients the reaction with acetic acid was negative. One was operated on by Moynihan at Leeds, the other by Pauchet at Amiens. Both were found to be bearers of a duodeno-pyloric ulcer.

The author's results, in his opinion, indicate that the so-called Anglo-American formula is not sufficient to justify operation. He believes that in the presence of delayed paroxysmal pains in the stomach we ought to suspect an ulcer of the duodeno-pyloric region. This

diagnosis ought to be controlled by an examination for hematin, which should give a positive result in the stools and a negative one in the cavity of the stomach. The results of these two examinations justify a surgical operation.

Use of the Duodenal Tube. E. H. Skinner¹ has investigated the diagnosis of duodenal ulcer by means of the Gross duodenal tube and fluoroscopy. The following is his technic: The small tube with a lead ball at the end is swallowed about fifteen minutes after the patient has taken a glass of milk. The patient takes an easy position, recumbent on the right side with the hips elevated. After about one-half hour to one hour the patient is fluoroscoped to see if the ball has passed the pylorus. A small amount of bismuth and water may be given (not through the tube). If the tube is in the duodenum it will appear independent of this bismuth stomach shadow. When it is determined that the lead ball at the end of the tube has passed the pylorus and is in the duodenum a suspension of bismuth in water (one-half ounce of bismuth oxychlorid to six ounces of water). is funneled into the tube, and thus it reaches the duodenum independently of pyloric activity. The patient, just previous to the injection of bismuth suspension, is placed on a framework and brought to a horizontal position on the right side. The duodenum, like an upright U, is thus filled with the bismuth suspension and this method lends itself to the estimation of duodenal pathologic conditions, especially in cases in which there is a stenosis or interference with the peristalsis; usually a peristaltic wave does not pass over an ulcerated area but excites spasms. The author presents the following conclusions:

We have been able to estimate a mechanical diagnosis of duodenal ulcer on the following: When a bismuth-and-water suspension is swallowed by a fasting patient, it readily passes the pylorus into the duodenum (because the acid gastric contents are not taken up as when food is offered the stomach, neither is there a closure of the pylorus as when a food bolus is swallowed). The stomach appears normal after the ingestion of a

(1) *Archiv. Int. Med.*, Nov. 15, 1911,

bismuth meal (2 ounces of bismuth oxychlorid to 13 ounces of porridge of one of the prepared wheat breakfast-foods), but there is a vigorous peristalsis and a rapid emptying of the stomach in as short time as one-half hour and at least in two hours. The duodenum seems to be sluggish and casts a shadow for a longer interval than usual, but the food rapidly traverses the remaining portion of the small intestines. By this method of filling the duodenum, as described above, the duodenum may present an hour-glass contraction at the site of the ulcer. Usually the duodenum is sluggish and does not exhibit any pronounced peristalsis. When the duodenum is filled and pressure is made at the outer curve of the duodenum as shown by the shadow, the patient usually experiences some pain or discomfort. The greatest weight is placed on the rapid emptying of a stomach that exhibits the usual normal J-shaped shadow.

The Duodenal Sound. P. Lazarus² describes an apparatus for extracting stomach and duodenal contents and for the purpose of duodenal alimentation. It consists of a ring-stand supporting two flasks provided with two side tubes to which are attached rubber tubes communicating with the stomach or duodenal tube and also with a piston syringe. The upper flask is provided with a manometer. The instrument is of value for various purposes of diagnosis and therapeutics. (See Fig. 15.)

Diagnostic Uses. 1. Obtaining and analyzing the juice of the duodenal chyme. A mixture of 4 digestive juices (gastric juice, bile, the secretion of the Brunner and Lieberkühn glands and the pancreas). It is especially of importance for testing the external function of the pancreas by the demonstration of the diastatic, lipolytic, and proteolytic ferments.

2. Local diagnosis of hemorrhage erosion which stained an introduced thread or piece of gauze with blood.

3. Quantitative inflation of the stomach or duodenum by means of an inflation bulb of definite volume. The forcing of air into the stomach is unpleasantly felt and sometimes localized, especially when an ulcer is present, while the air that reaches the duodenum is as a rule

(2) Berlin. klin. Wochenschr., Jan. 8, 1912.

scarcely felt. The inflation of the duodenum may be made use of in combination with radiography and the direct infusion of bismuth for pyloro- and duodenography.

4. By the simultaneous introduction of a secondary thread into the stomach it is possible to gain an insight

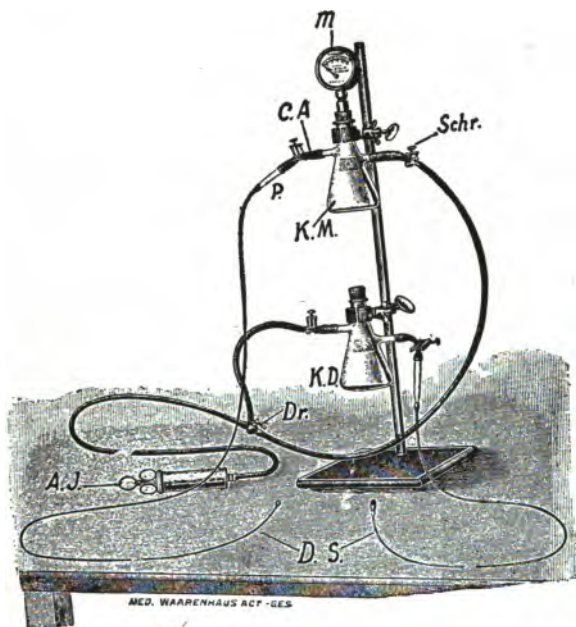


Fig. 15.—Combined stomach and duodenal infusion and aspiration apparatus. A. J., syringe; K. M., stomach flask; K. D., duodenal flask; C. A., tubing; Schr., clamp; P., pipette; D. S., duodenal sound; D. r., three-way stop-cock; M., manometer.

into the functional reciprocity of the digestive organs, and in analogy to the experimental biologic studies of Pawlow, to observe the course of the secretory and fermentative relations; for instance, after the introduction of certain pharmacodynamic substances. The duodenal mucous membrane is the source of reflexes by which we are able to influence the functions of the stomach and pancreas.

Therapeutic Uses. 1. The introduction of remedies especially for local application or such as are rendered inefficacious by the action of the gastric juice.

2. Aspiration and lavage of the stomach and small intestine, in cases of catarrh or poisoning or where it is desirable to remove the residues which are occluded in the folds of the mucous membrane.

3. Stimulation of an active hyperemia, with the addition if necessary of a thermophor sound or the injection of hot air, as for instance in painful colics and also for the aspiration of gas in flatulence.

4. Artificial alimentation according to the method of Einhorn.

A Duplicate Duodenal Ulcer. P. V. Bystroff³ reports a case of ulcer of the duodenum having several points of interest. The patient was a girl of nineteen years, who died with the clinical diagnosis of septicemia. On opening the abdomen there were found loose adhesions between the gall-bladder and the duodenum, and on the walls of the two viscera two rounded losses of substance, identical in shape and size and sharply limited. On the side of the gall-bladder a perforation existed only at the center of the ulcer, while on the anterior wall of the duodenum the loss of substance was equal to the size of a punch. It was located 8 mm. from the pylorus. On opening the duodenum there was found on the posterior wall exactly opposite the anterior perforation a fresh ulcer having the same dimensions and the same characters; this ulcer had penetrated into the head of the pancreas and its base was covered with black clots. On removing them there was seen the opening of an ulcerated artery. The stomach and upper part of the intestine were filled with an enormous quantity of coagulated blood. There was also some of it in the gall-bladder. On microscopic examination it was seen that the ulcer was located in entirely healthy tissue; there was no zone of transition between the necrosed and the normal tissue and there was no trace of inflammatory reaction around the ulcer. The same characters were noted in the gall-bladder and pancreas.

There had been, therefore, multiple septic ulcers of

(3) Charkovsky Med. Jour., Vol. 12, No. 7; Abstr. in Presse Méd., Feb. 8, 1912.

the duodenum, and death was due to an internal hemorrhage which had passed unnoticed. The chief points of interest in this case are the multiplicity of the ulcers, their strict symmetry, their similar dimensions, their identical configuration, and their recent date. Everything indicates something peculiar in their origin of which the key is given by the clinical history of the patient. The patient was a demented girl who had reached an extreme degree of cachexia. Recently there had developed an enormous eschar on the sacral region situated chiefly on the left side. This eschar was extremely painful, so much so that during the last three weeks the patient was obliged to lie either on the right side or on her abdomen.

The explanation of the etiology is consequently not difficult. The lesions were situated in the zone bathed by the gastric juice. On the other hand the extreme cachexia of the patient hindered any healing of a lesion in the abdomen.

Symptomatology. As a result of the study of 100 cases of ulcer of the duodenum that had been diagnosed and confirmed by operation, and of some experimental work on a series of dogs, J. T. Pilcher⁴ has reached the following conclusions:

(1) Ulcer of the duodenum reflexly excites an hyperacidity of the gastric juice; (2) the maximum amount of secretion of hydrochloric acid in the stomach is due to a direct chemical action (hormones), and is at its height from one to four hours after meals; (3) it passes into the duodenum as hydrochloric acid, there being no food four hours after meals for it to work upon; and (4) it does not excite a flow of the duodenal juice directly and is not neutralized by the small amount present.

The relief of pain in duodenal ulcer follows the ingestion of any substance into the stomach, which neutralizes the acid gastric juice. This conclusion is based upon the following facts:

(1) Food taken into the stomach excites at once a reflex secretion in the duodenum; (2) the duodenal secretion is alkaline in approximately the same degree as the gastric juice is acid; and (3) this secretion is of

(4) Boston Med. and Surg. Jour., June 1, 1911.

sufficient quantity and concentration to neutralize the hydrochloric acid of the gastric juice.

At a recent meeting of the American Gastro-Enterologic Association A. L. Benedict⁵ reported a case of duodenal ulcer and stated that the lesion had probably existed quite a while before the beginning of the period covered by the history, six weeks. There were no marked gastric symptoms. It was not until sudden collapse took place that the real state of the patient's nutrition was realized. The ischochymia was appreciated. The absence of liquid bowel movements was attributed to organic pyloric obstruction of some kind, even before the momentary feeling of a tumor, but it was obvious that the obstruction was not absolute. Owing to the distortion of landmarks, the questions of gastric dilatation and hepatic contraction were not answered by the physical examination, and owing to the restriction placed on the post-mortem examiner, neither question was positively answered at necropsy.

The question of cancer arose early, and this diagnosis was considered highly probable at the outset; but with the demonstration of a degree of free hydrochloric acid this diagnosis of carcinoma, unless in its incipency, did not seem so probable, until the tumor was felt. In the author's experience, every case in which food has been retained in the stomach over twenty-four hours has proved to be malignant, but even considerable degrees of ischochymia do not warrant the diagnosis of malignancy.

Treatment. In cases of duodenal ulcer where immediate operation is not necessary G. Herschell⁶ follows the course here outlined in the treatment of this affection.

1. It should first be absolutely certain that there is no possible infection from the mouth.

2. The duodenal contents should next be examined, a pure culture made from any predominant organism found and if the opsonic index is found lowered a vaccine should be made and injected.

3. Absolute rest in bed for a sufficiently long period of time is essential.

(5) Boston Med. and Surg. Jour., June 1, 1911.

(6) Interstate Med. Jour., March, 1911.

4. A specially prepared serum in which the proteolytic enzymes have been removed and the antiferments concentrated into small bulk is given by the mouth in 10 c.c. doses after meals to remedy any deficiency of antitryptic and antilytic substances in the blood.

5. The acidity of the gastric juice is diminished by giving 8 to 10 oz. of hot Vichy water two hours after meals or the following powder stirred up with hot water:

R	Sod. bicarb.	gr. x
	Calci carb.	gr. x
	Sac. lactis	gr. x
	Ess. menth. pip	m. ii

6. Distention of the stomach must be prevented by giving atropine and alkalies to avoid pyloric spasm and by giving food in small quantities and finely divided, at comparatively short intervals, also by giving water between meals instead of at meals and hot instead of cold.

7. Herschell recommends the following to keep the bowels open:

R	Magnes. sulph.3 vi
	Ext. cascari liquid. (Parke, Davis and Co.)5 iii
	Tinct. belladonnæ	m. xxx
	(omitted if patient is taking belladonna in powders)	
	Aq. chloroformi, ad5 vi

8. Anemia is treated by cacodylate of iron in doses of gr. 0.01 made up to 1 c.c. with normal saline solution, and given by intramuscular injection so as not to interfere with the medicaments given by mouth.

9. Diet should fulfil the following indications: (a) It must have a high combining power for the acid of the gastric juice. (b) It must excite the flow of the gastric juice as little as possible. (c) It must not distend the stomach. (d) The products of its digestion must be as unirritating to the ulcer as possible. (e) It must provide a sufficient number of calories to preserve the equilibrium of the patient.

All these indications are met as far as possible by pounded meat, chicken and bread.

Duodenal Alimentation. M. Einhorn⁷ reports his later experience with duodenal alimentation with the following comment: The results of duodenal feeding are

(7) Med. Record, Mar. 9, 1912.

very satisfactory. We must, however, add the following explanation: Subjectedly all but one case (Case 16, George S., tuberculous ulcer of the stomach) were distinctly improved. That means there were present either no pains at all or only very slight pains after the partaking of food. Nearly all the patients were able to eat an ordinary mixed diet a few days after the period of duodenal alimentation. A marked increase in weight was later on observed in most of the patients. Objective improvement was noticed in three ways. (1) In some cases, in which the pylorus could be felt as a small oval swelling (about the size of a walnut), probably caused by a spastic condition, the tumor disappeared during the period of duodenal feeding and did not return afterwards. (2) In nearly half of all the cases of ulcerations of the stomach and duodenum, in which before duodenal feeding the thread test was positive, it became negative after treatment. This would point most likely to the fact that an actual cure of the ulcer had taken place. (3) In some marked cases of ptosis and dilatation of the stomach a considerable change of the position and size of the stomach during the period of duodenal alimentation was observed. In three cases the organ became much smaller, the stomach before treatment having extended down to the os pubis, as could be easily demonstrated by the splashing sound; after treatment, however, the lowest part of the organ was found in the region of the navel. This was found in the course of the examination, and may be of great therapeutic value.

We might try to study the influence of duodenal nutrition in atonic dilatation of the stomach. According to Einhorn's observations this method of treatment ought to be successful in such cases. Taken all in all, we may assert that duodenal alimentation is a therapeutic measure of considerable value in suitable cases, and can be warmly recommended.

CANCER OF THE DUODENUM.

A Clinical Case. A. Bassler and J. P. Grant^s report a case of carcinoma of the duodenum in a man aged 42.

(8) Amer. Jour. Gastro-Enterology, April, 1912, Google

A history of excess in alcohol and tobacco with considerable reduction in the amount within the last two years was elicited. Symptoms of gastric distress after eating began seven years previous to admission, and for seven weeks the patient had vomited after each meal, with more or less constant pain in the epigastric region, heart-burn, and regurgitation of a tasteless fluid, with an emaciation of 48 pounds. The patient had not noticed bloody or tarry stools but had occasional diarrhea. Palpation indicated a mass in the abdomen giving the impression of a hardness covered by a thickness of soft tissues, not especially tender and not moving on ordinary inspiration.

Examination of a test-meal showed a low degree of acidity without free acid. The feces gave no special information. X-ray examination showed that the stomach was of rather small size. The exit from the stomach began in three minutes and seemed to be continuing normally although the shadow of the duodenum was not distinct. The stomach was empty of bismuth at the end of five hours. An exploratory operation was made which showed that the anterior wall of the stomach and pylorus were normal. The duodenum was contracted throughout and thickened in its whole circumference and was hard and somewhat nodular. The thickening involved not only the duodenum but the posterior wall of the stomach for about one and one-half inches. The head and body of the pancreas were enlarged, hard and nodular. There were no metastases in the liver, stomach, or elsewhere. The case was regarded as inoperable, and the abdomen was closed without further surgery.

DISEASES OF THE INTESTINE.

DIAGNOSIS.

Examination of the Feces by Schmidt's Method. T. W. Stumm⁹ describes as follows the examination of feces after Schmidt's test-diet: The stool should be thoroughly ground with the addition of a little water

(9) Jour.-Lancet, Jan. 15, 1911.

and poured in a flat vessel colored black, or a clear one resting on a black ground; the layer should be thin. With a mounting needle one can examine any small particles that are seen on the background. The most important of these are:

1. Small or larger particles of connective tissue that are recognized by the whitish color and firm consistency. In some stools these are very numerous. These, if in any number, point directly to poor gastric digestion, for connective tissue is digested only in the stomach.

2. Undigested pieces of muscle are often seen as small brownish masses that are soft and easily torn apart. These point to poor proteid digestion in the intestine.

3. Small pieces of potato are frequently seen and are readily recognized.

4. The fatty stool is apparent by the glossy appearance and the light color.

5. Slime is recognized by the tenacious character and its color. It is only the slime that is intimately mixed with the stool that comes from the small intestine; that from the large intestine or rectum is apt to be seen as a layer on the outside of the stool.

6. Large crystals of magnesium or ammonium phosphate may be seen.

The microscopic examination is easily and quickly made by taking a small portion of the stool and preparing three slides. One is a natural specimen covered with a cover-glass and pressed out thin; another has a little Lugol's solution added to it; and to a third a drop of 30-per-cent. acetic acid, which is heated to boiling after being prepared.

By such a procedure the macroscopic picture is substantiated or some particle recognized that was previously in doubt. The starch is stained blue or black; muscle fibers in small pieces are here and there normally seen but to no great extent; the fat may be seen as soaps, needles, or in neutral drops; the mucus and connective tissue need no such recognition. Of the bacterial flora that is so abundant, the recognition of the clostridium, if present, is probably of the greatest value, owing to its association with intestinal fermentation.

The reaction of a normal stool is neutral. The pres-

ence of bile is tested for by adding a rather concentrated solution of HgCl_2 to a portion of the stool in water placed in a Petri dish and allowed to stand for twenty-four hours. A reddish color results normally from the hydrobilirubin; green portions or a whole green color are pathologic and due to the unchanged bile (bilirubin). [The feces of infants, however, normally give a green color.—S.]

The fermentation test of the feces as recommended by Schmidt is of practical value. A portion of the feces is placed in a simple fermenting glass apparatus and kept at a temperature of about 100°F. for twenty-four hours. Normally there is no gas produced; if there is a fermentation, due to carbohydrate decomposition, the color becomes lighter, and if due to proteid decomposition, darker. Sometimes there is little or nothing in the stool to cause one to suspect such fermentative change; still by this simple method, it will show plainly. The stool may appear mushy and have the appearance of containing gas on microscopic examination, but this will show the nature of decomposition, which frequently clears up some rather obscure condition,—the so-called “fermentative dyspepsia.”

Test for Starch Digestion. Goiffon and R. Tallarico,¹ working in Mathieu's laboratory, have modified the method of Robert and Strassurger for detecting amylase by the length of time before a solution of starch mixed with a solution of feces loses the power to stain blue when iodine is added. The 1-per-cent. solution of starch is mixed with an equal part of a 10-per-cent. solution of stool, neutralized and filtered. The mixture is kept at a constant temperature of 38°C. , and at regular intervals a drop of the mixture is brought in contact with a drop of iodine solution. When it ceases to stain blue the digestion of the starch has been complete. The stool should not be too fresh nor kept on ice, and there should not be the slightest admixture of urine. It is often enough merely to mix the stool and starch solutions in a test-tube, heat in hot water and apply the iodine test. If there is abundant amylase present, the starch will be digested in five minutes.

(1) *Archiv. des Mal. de l'App. Digest.*, January, 1912.

When great precision is desired, it is better to use a 5-per-cent. solution of the feces and dilute further with an acid solution made with 10 parts of a normal solution of hydrochloric acid, 5 parts of sodium chlorid, and water 1,000 parts. About 5 c.c. of stool are ground in a mortar with 50 c.c. of water. The mixture is poured into a test-tube and all above the 50 c.c. mark represents the volume of feces. Water is then added at the rate of 20 c.c. for each c.c. of feces. In another test-tube are placed 2 c.c. of the 1-per-cent. starch solution, 5 c.c. of the above acid solution, and the whole is heated in water toward 40° C. Then, noting the time, 2 c.c. of the solution of feces are added and at regular intervals a drop is dropped on a drop of the official compound solution of iodine until all bluish or reddish discoloration ceases. For extreme precision, the index of the findings can be the time required for digestion of the starch, divided by the dry weight per hundred of the stools. The findings of the test throw light on pancreatic functioning and on conditions in the large intestine.

THERAPEUTICS.

Meat Diet. C. N. Howard² reviews the work of Chittenden and others and concludes from this as well as personal and family experience that low protein diet can be accomplished most successfully by omitting flesh food. Personally, in the last thirteen months he has taken meat but three or four times. For this same length of time his two little boys (aged 4 and 6) have eaten neither fish, flesh nor fowl, and they are thriving to his entire satisfaction. He does not, however, thus counsel all patients in regard to meat, but frequently advises patients to diminish the quantity of meat and in some cases finally to omit it. The sudden stopping of meat will sometimes result in a sense of discomfort bordering on illness, due to a lack of accustomed stimulation. A gradual reduction, however, has not this drawback.

Even the best of meat has an increasing amount of testimony piling up against it. The end-products of carbohydrates and fats, are carbonic-acid gas and water.

(2) Jour. Indiana State Med. Assoc., Mar. 15, 1912.

These are easily taken care of. Proteins, however, produce crystalline waste products, uric acid being one of them. There is a theory that fatigue is in some way produced by these midway products of metabolism. Meat is an especial offender, for it not only produces the deleterious end-products common to the protein family, but it is especially rich in those of the purin type, and harbors the waste products of the slain animal, so that the person eating it has to get rid of these waste products as well as of his own. Thus we find that meat is particularly responsible for intestinal putrefaction and auto-intoxication, which beget fatigue and disease.

Digestibility of Foods. F. Best³ has investigated the influence of the preparation of foodstuffs and their digestibility. The digestibility was determined largely by the time at which the food left the stomach and its condition on leaving, as well as by the proportion of the food utilized and the effect on the intestinal canal. He sums up his results as follows:

The use of fat in the cooking of vegetables considerably increased the amount of the vegetable utilized. When fat was not used the food imposed less labor on the stomach and more of the vegetable reached the large intestine in coarser pieces so that it aroused the peristalsis of the large intestine. Investigation of various kinds of meat variously prepared showed that ham is the most easily digestible and boiled beef the most difficult, and that the various methods of preparation have an influence on digestibility only by their ability to increase the appetite more or less. The healthy organism possesses in a high degree the capacity to digest equally well the various kinds of foodstuffs prepared in various ways, if it has been possible in the kitchen to prepare the foods so that they come on the table in a condition to excite appetite and thus produce the psychic secretion and motility. Only a few foodstuffs are easily digestible in the ideal sense, that is utilizable to a high degree and remaining only a short time in the stomach and intestine. The representatives of the carbohydrates approach this ideal most closely (sugar, bread, potatoes); then come eggs and ham among the forms of meat (lean meat

freed from tendons). Moreover, it must be recognized that well utilizable food stuffs tax the stomach and intestine more, and that in their preparation we are in a position to favor the stomach only at the cost of the intestine or *vice versa*.

Relation of Digestibility to Dietetics. The digestibility of articles of diet is an important factor in estimating their nutritive value. These relations are well expressed by T. Brugsch⁴ in a recent work. A food is digestible in proportion to the rapidity with which it leaves the stomach. The degree of digestibility depends on several factors: the amount of the food eaten, its volume, its special chemical composition, the method of its preparation, its mechanical condition. Moreover, the time at which certain foods are eaten plays a part in determining their digestibility. Many foods are borne worse at night than at midday.

Among the special varieties of food fat is the least digestible, as it is the last to leave the stomach. Regurgitation of pancreatic juice into the stomach occurs in consequence of the presence of fat in the organ; the alkaline pancreatic juice neutralizes the acid of the stomach and thus hinders gastric digestion. As a rule other foodstuffs are digestible in proportion to their freedom from fat; hence cooking in fat is apt to render foods less digestible. The form in which food is eaten has also an influence on its digestibility; meat which is imperfectly chewed and enters the stomach in large lumps remains for a longer time undigested than that which is taken in a finely divided form. Carbohydrates, whose period of stomach digestion is soon ended, leave the organ the sooner the more finely divided they are by previous preparation, cooking and chewing, and the more thoroughly they are mixed with saliva.

The more readily a food appeals to the appetite, the more acceptable it will be in a doubtful case. It is a common observation that persons whose digestion is imperfect will often fail to digest things apparently easy of digestion, and will often bear articles in themselves difficult to digest because they have a marked appetite for them. As a rule one should take the appetite into

(4) Diätetik inn. Krank., Berlin, 1911, Verlag Julius Springer.

consideration in providing for the diet of patient, and aim to secure the greatest variety in the food and the greatest degree of palatability by the method of cooking and serving. For this reason the spices and seasonings must not be neglected in arranging the diet.

While the function of the stomach consists mainly in the partial preparation of the protein elements for intestinal digestion by conversion of the coagulable albumins into soluble non-coagulable peptones (albumoses), the carbohydrates and fats are pushed on into the small intestine together with the partially digested proteins for complete conversion into soluble and absorbable bodies.

The neutralization of the acid chyme on entering the small intestine checks the action of the pepsin, while the digestive action of the mixed pancreatic and intestinal juices becomes possible. The digestive process is completed in the small intestine and the chyle is delivered into the large intestine in a thoroughly disintegrated condition, both mechanically and chemically. The proteins are converted into peptones and to a great extent into amino-acids, the carbohydrates into soluble glucoses, and the fats into soaps.

Fermented Milk. P. G. Heinemann⁵ criticizes the extravagant claim made for milk soured by the *Bacillus bulgaricus*. The claim that it will prevent premature senility, auto-intoxication and other disorders has been augmented by the commercial producers of sour milk and ferment. According to repeated statements stomach troubles, scarlet fever, whooping cough, anemia, scrofula, gall-stones, diabetes, chronic rheumatism, dysentery, appendicitis and tuberculosis can be cured by use of Yoghert. On the other hand the results of more conservative investigators have shown that the Bulgarian bacillus cannot be permanently located in the colon. The statements that it will reduce the number of bacteria in the feces are not reliable, because the number of living bacteria is liable to great variations from day to day. In an extensive study of commercial ferments the author found that most commercial preparations

(5) Jour. Amer. Med. Assoc., Apr. 27, 1912.

do not contain Bulgarian bacilli and are worthless for the preparation of Bulgarian sour milk.

In summarizing the subject it may be stated that sour milks are probably of value as food if used with discretion. They should be taken as part of the usual diet rather than in addition. One quart of milk contains about the same nutritive value as a pound of beef. If a quart of milk is consumed daily the amount of other food should be reduced proportionately. It is a significant fact that the warmest advocates of the use of Bulgarian sour milk emphasize the necessity of regulating the diet by reduction of meat and increase of carbohydrates and vegetables. Metchnikoff has stated that premature senility can be prevented by regular diet, decrease of meat and regular consumption of Bulgarian sour milk. There is much reason in this statement, but it should not be concluded that Bulgarian milk is a panacea and that intestinal putrefaction will be reduced unless moderation in diet is practiced. In the preparation of Bulgarian sour milk previous boiling is advisable to insure the absence of pathogenic germs and to avoid abnormal fermentations. Of prime importance is the choice of a suitable ferment. The Council on Pharmacy and Chemistry of the American Medical Association has examined a number of commercial preparations and has recommended those which were found efficient.

INTESTINAL TOXEMIA.

Intestinal Toxemia and Chronic Arthritis. The following conditions are enumerated by C. C. Sutter⁶ as having an etiologic relationship to joint affections: 1. Typhoid fever. 2. Bacillary dysentery. 3. Appendicitis. 4. Amebiasis. 5. Parasites. 6. Fecal retention. In most of these cases the relationship is more or less obscure. He considers that the following changes in the abdomen might lead to an increased production of toxin and ultimately to a chronic arthritis: 1. Ptosis and dilatation of the stomach. 2. Ptosis of the small intestines. 3. Ptosis of the ascending and descending colon. 4. Ptosis of the cecum. 5. Ptosis of the transverse colon.

(6) N. Y. Med. Jour., Feb. 4, 1912.

6. Ptosis of the sigmoid. 7. Ptosis of the abdominal wall and posture. 8. Gastric and enteric catarrh.

The general result of these abdominal disturbances is as follows: Retention of food in the stomach with the imperfect stomach digestion due to general atony of the organ and improper drainage. Imperfect digestion due to interference with the function of the pancreas. When there is distinct visceral ptosis the liver also sags, with consequent interference with its function and insufficient quantity of bile. Retention of feces in the colon or sigmoid causes fermentation and putrefaction. If such conditions exist long enough they might naturally result in disturbances so marked that they would lead to abnormal absorption and cause systemic manifestations of varying types.

There is little doubt that chronic putrefactive toxemia can produce, or strongly assist in producing Bright's disease, arteriosclerosis, cirrhosis of the liver, obstinate headache, epileptoid attacks, functional disorders of the heart and the vasomotor system, irregular fevers, and neurasthenia.

In all of these conditions marked benefit is usually derived from treatment which diminishes putrefactive toxemia. Many cases of rheumatoid arthritis improve markedly under treatment directed against intestinal toxemia; namely, the prevention of the formation, the decrease of absorption, increase in the elimination or increase in the destruction of toxins.

The stools have been examined in a number of cases, but none of them showed any peculiarities that are not found in patients who do not have arthritis. No bacteria have been found other than the *Bacillus coli communis* and spore-forming anaërobic bacteria. It is wise always to examine the stools of patients with chronic arthritis, as many times they will show the existence of intestinal dyspepsia which may be the point of origin of the toxemia.

The urine in a number of these cases was examined by Helen Baldwin. All but 2 of the 21 cases showed either an excess of aromatic sulphates or the presence of indican. Considerable variation was noted. In some instances indican was entirely absent, while in others

products of putrefaction (aromatic sulphates) were in excess of normal. In still other instances indol, skatol, or phenol was found in excess, although their total amount was not usually great. There might be some question in such cases as to their being of intestinal toxemic origin. In all cases tested at The Glen Springs indican was found at one time or another. Sutter has tried to work out the existence of acetonuria in cases of arthritis deformans, but so far has not reached any conclusion. Sutter reports a typical case of arthritis deformans due to intestinal toxemia.

The diagnosis is not always definite in these cases but it can be made provisionally when intestinal toxemia is an important factor, and especially when it has been present previous to the advent of the first symptom and when a ptosis or malposition of the abdominal viscera can be discovered by the Röntgen ray in cases of chronic arthritis. The value of the bismuth-Röntgen-ray test in cases of chronic arthritis which seem to be due to intestinal toxemia may be summed up as follows:

1. By means of the bismuth-Röntgen-ray test we can determine in each case the length of time consumed by the contents of the gastro-intestinal tract in reaching each division of the tract and the time in which the division is completely emptied.

2. The normal motility of each part of the gastro-intestinal tract can be definitely established.

3. The presence of ptosis, obstructions, redundant colon, gastric and duodenal adhesions can be determined.

4. The ordinary methods of medical treatment can be more intelligently applied with the definiteness of diagnosis accomplished by this test.

5. The question of the advisability of a surgical procedure can be settled.

6. The bismuth-Röntgen test is harmless and practical.

The *treatment* involves the regulation of the diet by excluding substances liable to putrefaction, especially meat, and by providing for efficient functional activity of the digestive organs. Antiseptics are of doubtful utility. Excellent results have been reported from the use of thymus extract. Laxatives may be valuable but the

author has seen absolutely no indication for drastic eliminative treatment. This, indeed, may increase the absorption of toxic products from the intestinal tract.

Colonic irrigations are used to a great advantage in these cases by removing irritating particles in the state of decomposition and at the same time giving daily evacuations. It is possible to introduce the tube into the descending colon and, by means of physiologic salt solutions, the large intestine may be washed free of its contents. This procedure has now been frequently practiced with extremely beneficial results in the direction of diminishing excessive intestinal putrefaction. Herter says he has known it in several instances to be followed by a reduction in the output of ethereal sulphates and in the excretion of indican by the urine. It also gives relief from headache, mental depression, irritability, flatulence, and the arthritic pains which are common in these cases. If the lavage be practiced cautiously with respect to the avoidance of an excessive volume of fluid, the method may be applied for a considerable period of time without discernible harmful effects. It is perhaps better to employ irrigation two or three times a week than to use it daily. Where excessive quantities of fluid are used, distention of the colon occurs and may be followed by troublesome atony. Great discomfort may also be caused and the patient may rebel against the treatment.

Operative procedures may be demanded, such as colostomies, cholecystostomies, appendicostomies, resection of redundant colon or sigmoid, and operations on the stomach. It seems highly probable that the relief afforded in these cases has been due in most cases, in part at least, to the greatly improved conditions of bacterial activity which followed the removal of a source of stagnation and putrefaction in the digestive tract. Pyloroplastic operations have been known to be followed by diminished ethereal sulphates.

E. Cornwall⁷ reports 12 cases of chronic putrefactive toxemia of intestinal origin, all of whom presented the following symptoms: Severe and frequent or continuous headaches, mental and physical debility, neurasthe-

(7) Med. Record, Dec. 23, 1911.

nia, functional disorders of the heart, irritative cough, glycosuria, severe chronic universal eczema, toxemia of pregnancy, arthritis deformans, irregular fever, cardiovascular disease, and nephritis. In all these cases the administration of a diet which diminished the production in the intestines of the poisons due to the action of the saprophytic bacteria on animal protein, and at the same time relieved the liver and kidneys from unnecessary work, was followed promptly by recovery or great improvement. Cornwall draws the following general conclusions from his investigations:

1. Man's natural diet is a mixed one, derived from both the animal and vegetable kingdoms; and it appears to be a fact that on such a mixed diet, other things being equal, he flourishes best and attains his highest development.

2. In the normal physiology putrefaction products are regularly formed in the intestines as a result of the action on animal protein of the ever-present saprophytic bacteria. These putrefaction products, some of which possess toxic properties, being soluble, are absorbed into the circulation; a portion of them is destroyed or neutralized by the antitoxic organs of the body, and the remainder, after having produced a putrefaction toxemia, is eliminated.

3. Putrefaction toxemia, which is a regular and normal occurrence in the healthy body, acquires pathologic significance only when it becomes excessive, or relatively excessive.

4. When this toxemia is excessive, or relatively excessive, either because of too much animal food in the diet, because of abnormal conditions in the gastro-intestinal tract, because of insufficiency of the liver or kidneys or other antitoxic or eliminative organs, or because of low tissue resistance, then it directly produces morbid conditions or aggravates existing ones.

5. The diagnosis of the pathologic complex due to chronic putrefaction toxemia of intestinal origin can be made with ease, safety and reasonable quickness by the therapeutic method, which consists in giving the appropriate treatment in suspected cases and watching the result.

6. The treatment of this condition is essentially dietetic, and consists in reducing to a rational minimum the amount of putrefiable protein ingested; increasing the amount of lactic acid formed in the lower part of the alimentary tract; eliminating cane sugar and other disturbing articles from the diet; including in the diet articles which are laxative; and reducing the total amount of food to the needs of the body.

The Gas Bacillus as a Cause of Intestinal Fermentation. L. Kendal and H. F. Hewes⁸ present a study of the gas bacillus as an agent of intestinal fermentation and diarrhea. The finding of gas bacillus (*Bacillus aërogenes capsulatus*) in excessive numbers in the feces of patients suffering from attacks of acute diarrhea, is a fact, substantiated at the present time, by a considerable number of observations. The most comprehensive observation in this regard is that of Kendal and Smith, who report the finding of large numbers of this organism in the feces of 14 cases of infants suffering from what appeared to be, as far as the clinical symptoms of the malady, exclusive of the bacteriologic finding of the feces, go, acute infectious diarrhea of the type of dysentery. No Shiga or Flexner bacilli were present in any of these cases.

This fact of the association of the gas bacillus with dysentery in these cases was particularly striking and suggestive, owing to the fact that the cases were in nurslings, and, according to the observation of these authors, the gas bacillus, though occurring occasionally in small numbers in the feces of apparently normal adults and children fed on general food materials, is never present in the feces of normal nurslings.

This association of the gas bacillus in excessive numbers with acute infectious diarrhea of the clinical type of dysentery occurs in adults as well as children. Hewes reports two cases which have recently come under his observation.

That this fact of the association of the gas bacillus with these cases of acute diarrhea or dysentery indicates an etiologic connection between this organism and the dysentery, or even the fact that the gas bacillus is an

(8) Bost. Med. and Surg. Jour., Jan. 18, 1912. by Google

active agent at all in producing or keeping up the diarrhea of the disease, cannot, of course, in the present condition of our knowledge of this subject, be claimed with absoluteness. There are, however, certain facts which have been determined in the observations mentioned, besides the main fact of the association of the bacillus with the malady in question, which are strongly suggestive of the fact of an etiologic connection, or at least of the fact that the bacillus, even if its appearance in the case is accidental, as regards the first cause of the pathologic condition present, is an active cause in producing intestinal fermentation and diarrhea in these cases. The principal fact of this kind is one brought out in the study of the treatment of these cases. A study of these cases shows that they do not improve but the diarrhea is actually made worse on a diet containing much sugar. On the other hand they are benefited by the introduction of lactic acid in the form of buttermilk.

The gas bacillus may also act as a source of irritation and cause fermentation in cases where there is a pathologic alteration of the mucous membrane of the intestine. The authors report two cases. Both belonged to the type of pathologic condition known as chronic colitis. The clinical picture in both was one of continuous diarrhea covering a period of one or more years, associated with mucus, pus, and sometimes blood, suggesting the existence of a condition of chronic inflammation of the colon membrane. Both cases at the time that they first came under observation had, on a mixed diet of proteid, carbohydrate and fat, several loose stools daily, of a curious, foamy, whipped cream appearance suggesting the presence of excessive gas formation. Under the microscope the feces showed an excessive content of bacterial forms. Culture in both instances showed the presence of an excessive number of gas bacilli, litmus milk inoculated from the feces and heated at 80° C. being completely peptonized and showing the characteristic gas formation within eighteen hours. Upon removal of the carbohydrate food from the diet, except the carbohydrate contained in the buttermilk given, a complete change in the character of the stools occurred, the number decreased, the foamy appearance vanished. In one

case the stools became formed and the diarrhea disappeared. In both cases under this change of diet the excess of gas bacilli disappeared, returning, together with the diarrhea, on a return to carbohydrate diet.

The idea that an infection with the gas bacillus is the original cause of the intestinal lesions in these cases or that this organism is causing a secondary infection in these lesions, on top of an original cause, is, of course, merely speculation. In favor of such a supposition we have the records of the cases of acute infectious diarrhea with the feces findings of mucus, pus and blood, associated with the finding of the gas bacillus, mentioned in this paper.

CHOLERA NOSTRAS.

Choleriform Syndrome. E. Joltrain and M. Maillet⁹ describe the symptoms observed in cases entering the hospital with a suspicion of Asiatic cholera, in which the symptoms proved to be due to a different infection. The symptoms varied from those of a severe diarrhea with a condition of moderate collapse from which the patients readily recovered to fatal cases in which the differential diagnosis from true cholera was very difficult. The authors sum up their results as follows:

Our bacteriologic tests have shown in the majority of cases the presence in the stools of special germs approaching more or less closely the cholera vibrio of Koch. The morphology which was apparently identical especially in two cases, the same cultural characteristic non-coloration by Gram's method and the cholera red reaction, were the principal points of resemblance between these vibrios and that which is regarded as the specific germ of Asiatic cholera. However, there are certain characters which permit a differentiation. These are the presence in the cultures of elongated forms, the late appearance of the indol reaction, and especially the absence of a sharp agglutination by anticholera serum which strongly agglutinates the vibrio of Koch. These facts, which are well known, indicate the difficulty of making a differential diagnosis either from a chem-

ical or bacteriologic point of view or between the choleric form syndrome and Asiatic cholera. It is not possible to make this distinction by a rapid examination. It is very difficult to isolate the germ, and it is necessary before coming to a positive conclusion to apply all the methods that have been indicated. The importance of this diagnosis is, however, so much the greater as the essential phenomenon which differentiates all these choleric form syndromes from Asiatic cholera is the complete absence of all epidemic and contagious characters.

Moulds in the Alimentary Canal. I. P. Hall¹ brings out the fact that mould in the vomit and feces has hitherto received insufficient attention. He believes that it has causal relations to such conditions as cholera nostras and infantile diarrhea where it is the most prominent symptom. His belief is based on the following reasons:

1. It is often present when no other sufficient cause of the symptoms are to be found.
2. It is present in abundance in some of our most fatal diseases.
3. Its partial destruction is followed by immediate improvement.
4. Its complete removal in such cases is an essential element in recovery. He finds that the green mould is killed by sodium bicarbonate, which he gives in teaspoonful doses, frequently repeated. He also gives lysol to kill the numerous bacteria that accompany the mould.

INTESTINAL OBSTRUCTION.

J. W. Draper² records some experiments made with a view of determining whether the symptoms resulting from intestinal obstruction are due to an autotoxemia and how far the effects of this autotoxemia could be obviated by the introduction of epithelial cells from healthy mucosa. He gives the following summary of results:

1. Epithelial cells of jejunum and ileum given by mouth to duodenally obstructed dogs prolonged life in a series of 15 animals by about thirty-six hours over a similar series to which they were not given.

(1) Canadian Med. Assoc. Jour., December, 1911.

(2) Jour. Amer. Med. Assoc., Oct. 21, 1911.

2. The average pulse-rate of the treated dogs was thirty-three beats lower than that of the untreated.

3. The belief that we were dealing with a cytologic product was strengthened by the trend of the charts. These showed that beneficial action occurred early, just as in the case of any successful treatment by antibodies.

4. The chemical determinations in one animal showed a normal nitrogen metabolism after duodenal obstruction and suggested a decreased functional power of the liver in terms of glycuronic camphor.

5. This series is far too small to justify any positive conclusions. Its value is simply that of a suggestive working basis.

ABDOMINAL CRISES.

According to M. Loeper³ gouty and oxalemic abdominal crises may be classed in two great categories, acute and chronic, which sometimes affect the stomach, sometimes the intestine and frequently at the same time all the parts of the digestive apparatus. Acute crises comprise: Gouty crises, characterized especially by painful distention of the stomach; acute dilatation with intolerance, vomiting, cold perspiration, chilliness, and a tendency to syncope; spasmodic colic; painful diarrhea; neuralgia resembling that of lead poisoning; tabes; and abdominal arteriosclerosis. Chronic crises are characterized by phenomena of dyspepsia, early or late pain, alternate constipation and diarrhea, spasmodic intestinal cramps, digestive atony and even repeated mucorrhea.

The chemical examination of the stomach contents gives various results, but the hyperchlorhydria is scarcely proportionate to the intensity of the painful phenomea. The intestinal and pancreatico-biliary chemistry has hardly been studied, but it may be concluded *à priori* that the frequency of the hepatic reaction depends on the existence of secretory changes in the digestive tube and the adjoining glands.

Examination indicates not more than the normal amount of uric acid, but an excess of oxalic acid is frequently found. Experiments in animals show that the

(3) Prog. Méd., Oct. 28, 1911.

injection of oxalates provokes a muco-membranous enteritis. No chemical basis or anatomic changes in the mucous membrane can be found to account for the symptoms. The pathologic origin must be sought for in the nervous system.

The author has observed only one case of abdominal crisis of the gastralgic type. This was in a gouty subject 34 years of age who suffered for 3 or 4 days with extremely violent pains in the epigastrium, accompanied by contractions of the abdominal wall, alimentary or mucous vomiting, and constipation. The gastric secretion was normal and the vomitus contained no oxalic acid. The urine contained 0.70 cgr. of uric acid and 2 cgr. of oxalic acid, and the blood contained 6 cgr. of oxalic acid during the crisis. After the crisis the urine was loaded with 1.20 gm. of uric acid and 7.0 gm. of oxalic acid. In this patient facial neuralgia and pains in the small joints alternated with the abdominal crisis.

The author regards abdominal crises referred to the intestines as more frequent. They are characterized sometimes by diarrheic discharges, accompanied by marked pain, sometimes by spasmodic enteralgia. Loeper cites several examples.

Aside from these acute forms about whose nature and origin there is scarcely any doubt, chronic forms must be described which take the aspect of gastro-intestinal dyspepsia, the diagnosis of which would be impossible if an attack of gout did not occur sooner or later to give the explanation. The excess of oxalic acid in the blood, the retention of these products during the attack, their elimination when it is ended, the efficiency of eliminating agents in contrast to the frequent inefficiency of ordinary gastric or intestinal therapeutics, are arguments in favor of the cause being an intoxication with these products.

The crises in gouty patients and those affected with oxalemia appear to be a toxic cœlialgia; their origin and nature are identical with those of certain facial, intercostal, and sciatic neuralgias, since oxalic acid is present in the solar plexus and its branches, just as it is in the general nervous system. The solar system controls and regulates the gastro-intestinal secretions and movements, and its irritation produces painful diarrheic, spastic or

paralytic symptoms. Gastralgia, enteralgia, or gastro-enteralgia are thus explained, with their train of objective and subjective reactions, their non-painful points and the integrity of the organ itself. The abdominal crises of the gouty, slight or severe, are or may be instances of solar cœlialgia, and this cœlialgia takes its place beside the truly organic affections of the mucous membrane, gastritis, enteritis, mucorrhœa and lithiasis.

Such a hypothesis finds confirmation in the results of therapeutic applications. Many of these attacks improve or recover under the influence of remedies directed to the cure of gout or neuralgia, and this forms the basis for the treatment recommended.

During the attack opium, belladonna and other sedatives may be employed and are sometimes of great service. Counter-irritation to the joints may be undertaken. In the interval one must insist on proper modification of the diet. Meat, spices, foods rich in purins, calves feet, gelatin and foods rich in oxalates must be forbidden. Coffee, tea, rich wines, effervescent beverages, and other stimulants must be excluded from the menu. Soups, potatoes, fresh butter, and dishes made from milk may be recommended. Saline purgatives and diuretics should be employed to secure elimination. Solutions of phosphates, citrates, bicarbonates and sulphates of magnesium may be useful to secure the precipitation of the oxalic acid within the digestive tract and thus prevent its absorption.

The author recommends some solvents of uric acid, although experience has shown that these uric acid solvents are generally valueless. Salts of calcium should be administered because calcium combines with and neutralizes oxalic acid and also because the elimination of oxalic acid brings about a genuine decalcification of the organism.

INTESTINAL ARTERIOSCLEROSIS.

L. Lagane⁴ discusses the characteristics of the syndrome produced by arteriosclerosis of the intestinal vessels. This has been founded chiefly on the element of

pain and is not very characteristic. The author endeavors to explain the nature and origin of the lesions producing these painful attacks on the basis of his experimental and clinical observations. Two kinds of lesions produce this syndrome, atheroma of the mesenteric arteries and arteriosclerosis of the arterioles of the intestinal wall. The first seems to exist most frequently with chronic lesions of the aorta and of the rest of the vascular system, and is found frequently in syphilitics and ordinarily in people who have passed the fiftieth year and are the subjects of atheroma; the second occasions more frequently acute or chronic affections of the intestine and is seen in younger subjects, alcoholics, those affected with lead poisoning, and frequently syphilitics or in those who have had typhoid fever, or patients formerly affected with acute or chronic infections of the intestine, and finally in patients whose intestine has already for some reason been the seat of curable lesions of infarction. The painful symptoms are analogous to the crises of angina pectoris, either coinciding with those attacks or frequently alternating with them. They occur as the result of some effort, often without relation to the ingestion of food. The effort may be physical such as walking or laborious digestion, emotion, intellectual overexertion, and is followed by extreme pain, compared to a burning or a crushing sensation or sometimes taking the form of intestinal colic. During the crisis there exists sometimes an exceeding sensitiveness of the abdominal aorta.

In general the intestinal symptoms are of little importance either during the crises or in their intervals. Constipation, abdominal meteorism, and sometimes alternating diarrhea and constipation or the passage of membranes are the most prominent. Constipation may proceed by crises coming on at intervals more or less long, sometimes every day and most frequently after a hearty meal with the ingestion of food difficult of digestion. These attacks are similar to the spasms in the limbs known as intermittent claudication. They are characterized by marked meteorisms, often unequally distributed through the different parts of the abdomen, and not accompanied by intestinal contraction. The pa-

tient has eructations and nausea, vomiting and a painful sensation of tension in the abdomen and sometimes very severe pains.

Lagane attributes these attacks to an ischemia more or less complete, of the intestine, connected with lesions of the arterioles which, occurring when the functions of the intestines should be the most active, bring on painful cramps with transitory paralysis of various parts of the intestine, and may produce a secondary congestion and even small limited infarctions. He bases his view on experimental work in the dog by which he has been able to produce an analogous syndrome by ligature of a certain number of arterioles, and after laparotomy has always been able to demonstrate the extreme congestion of the intestine. Secondly, in conditions clinically analogous there has been found on surgical intervention a congested intestine of a violet color with minute apoplexy and sclerotic lesions obliterating the vessels. Hasenfeld has even seen crises of intestinal miopragia precede the occurrence of gangrene of a loop of intestine due to arteriothrombosis.

Diarrheal crises and especially crises of bloody diarrhea, form one of the most important symptoms of the localization of arteriosclerosis in the intestine. It is a diarrhea with abundant watery stools, bloody or melenic for some days, accompanied by paroxysmal pains and often followed by distinct but temporary symptoms of intestinal occlusion. It is easily distinguished from the ordinary diarrheas that may be observed in these patients. The author considers that this diarrhea is the result of true edema of the intestine. In certain cases the limited infarcts result in ulceration of the intestine of a dimension equal to a 50-centime piece (about a dime), and affecting the mucosa and submucosa.

Finally the most important lesion is a hemorrhagic infarct of the intestine. It represents the most severe complication, the *syndrome ultime* of intestinal arteriosclerosis. It begins abruptly with atrocious pains and follows a characteristic evolution in two phases: general signs of severe hemorrhage, intense intestinal pains, vomiting (sometimes of blood), abundant profuse diarrhea (most frequently of a bloody character), me-

teorism, and then symptoms of intestinal occlusion. Its duration is from three to four days and its termination almost always fatal. It may exist in a remittent form, the remissions sometimes lasting for several months, or in chronic form. The injured parts are rapidly invaded by intestinal microbes which bring on gangrene. Such a picture is naturally attributed to a thrombosis of the large venous trunks which actually exists but is only a secondary phenomenon. In reality the first cause of the lesion is often atheroma of the mesenteric arteries, combined or not with lesions of the arterioles. Experimental studies have enabled the author to reproduce all the clinical forms of infarct and to connect them with the slight circumscribed infarcts with favorable evolution which have been described. Very rarely obliterating lesions of the intestinal vessels cause a necrosis in mass of one of the segments.

The diagnosis of disease of the intestinal arteries is always difficult on account of the absence of pathognomonic symptoms. It is only the grouping of the symptoms and their connection with the arteriosclerotic antecedents of the patient with the previous occurrence of syphilis or intestinal disease, that can arouse suspicion. Its character may be indicated by the good results of medication directed to the vessel, such as nitroglycerin, iodids, theobromin, etc. Buch insists on the high therapeutic and diagnostic value of tincture of strophanthus (60 drops daily in three doses), and Raulin recommends the association of theobromin and strophanthus.

Treatment of Gastro-Intestinal Arteriosclerosis. M. S. Bonnamour⁵ divides the treatment into three sections according to three sets of indications:

1. Symptomatic indications derived from the pains, which are often violent, produced by the spasm of the vessels of the stomach and intestines. Morphine is the principal sedative, but like the other narcotics, it is often without effect on these painful crises, which are, on the other hand, susceptible to the remedies which are commonly used for combating stenocardia and in general for symptoms of arteriosclerotic origin.

Kreuzfuchs recommends the association of morphine

(5) *Gaz. des Hôp.*, Sept. 16, 1911.

with camphor, which association has the action of a cardiac tonic. Buch has especially recommended the tincture of strophanthus and theobromin. Jaquet has attained good results by the use of potassium iodid or by potassium nitrate combined with nitrate of sodium, a mixture which was recommended by Lauder Brunton for chronic arterial hypertension. According to Raulin intestinal arteriosclerotic crises will be relieved by theobromin or strophanthus, and this is real diagnostic therapy, since no other form of colic yields to the use of these remedies. Finally hot applications under the form of compresses soaked with hot water or of poultices on the abdomen, of hot drinks, and hot enemata with the addition of chamomile or mint will aid in soothing the patient.

2. Indications of a prophylactic nature which are concerned with the removal of everything which may persist in provoking action. The use of tobacco and alcohol must be given up. Constipated persons should be directed to employ enemata, sitz baths, abdominal massage, which has a particular reputation as exercising an inhibiting influence on the painful attacks, and the moderate use of saline laxatives (violent purgatives and especially drastics should be avoided). To avert the return of the attack these patients should be recommended to live a calm and regular life, free from agitation and from excess of all kinds, particularly faults of diet and physical overwork. They should also be recommended to protect themselves from damp cold air especially during digestion, cold during such a season tending to produce vascular spasm of the vessels. They should wear a flannel bandage, and should arrange their bed in such a way that the head and upper part of the trunk will lie on a higher plane than the abdomen and the lower limbs.

3. Indications of a causal nature have reference to the well-known remedies for arteriosclerosis and hypertension. These include the iodids of potassium and sodium in small doses, the diuretics, nitroglycerin, and sodium silicate. Finally a lacto-vegetarian diet is to be instituted because it favors the elimination of toxic refuse and the products of activity of the organ, while it re-

duces to a minimum the production of these organic poisons.

ENTEROPTOSIS. ASTHENIA CONGENITALIS WITH SPLANCHNOPTOSIS.

The original conception of gastropotosis was that of a local malposition of the stomach which received the name gastropotosis. Subsequently, as it became evident that other abdominal organs participated in the falling of the stomach, the term enteroptosis gained in favor as giving a broader idea of the affection. With the realization that the disease was not confined to the abdominal organs, the term splanchnoptosis was proposed as being more general and corresponding to the known facts. It was the task of Stiller to trace the ptosis of the organs to a constitutional, congenital vice of nutrition which he expressed by the designation, *asthenia universalis congenita*. J. C. Hemmeter,⁶ in an exhaustive article on the subject of splanchnoptosis, regards the terms enteroptosis and splanchnoptosis as inadequate and misleading, for the displacement is only part of the great complex of pathologic events that are classed under these terms.

The following are the principal structures that are in an abnormal condition in the state above defined: (1) The osseous structures and joints; (2) the nervous system, especially the autonomic and sympathetic system; (3) the heart and bloodvessels; (4) the organs of digestion and metabolism; and (5) an unknown (cryptogenic) disturbance of internal secretion. As a result of fundamental changes in these structures we find displacement and prolapsus of the viscera as a necessary consequence. The displacements are not the cause of the manifold symptom-complex, but rather the result of it, if we can speak of a thing being a result that is congenital.

It is incorrect to call a certain position of an organ when not normal, a ptosis, meaning a falling or prolapsed organ, when that organ never has been in normal position. We can only logically speak of a falling

(6) Interstate Med. Jour., 1911.

or ptosis when an organ descends from a higher to a lower position. This is not the case in genuine enteroptosis, for individuals, who have the evidences of the four deranged states just mentioned—namely, disproportion of the osseous system, abnormal autonomic nerve function, infirm cardiovascular function and displaced viscera, never have been normal and are born with all these infirmities. According to Stiller enteroptosis is only a part phenomenon of a very special form of body constitution which he designates by the term *habitus enteroptoticus*. The term congenital asthenia is recommended as a substitute for the term enteroptosis. Universal congenital asthenia with splanchnoptosis would represent a more comprehensive term. It is true that the splanchnoptosis is the principal element of the disease when these sufferers present themselves to the clinician, for then they exhibit mainly four abnormal conditions: (1) Lack of tonus in the heart, bloodvessels and muscles; (2) displacement of one or more of the viscera; (3) neurasthenia; and (4) one or more of the varieties of indigestion, usually of the type called nervous dyspepsia.

In the splanchnoptotic neurasthenic the abdominal viscera never rise from their original infantile position to their normal adult position. The liver, stomach, and spleen are prevented from occupying as high a position in the splanchnoptotic, because there is no room for them to rise in, owing to the narrowness and elongation of the bony thorax. The viscera cannot occupy their normal position, for the simple reason that there is no room for them; and this lack of room is due to the disproportion of the osseous structures of the body, this osseous malformation being inherited and handed down from generation to generation. Hemmeter takes no account of acquired cases which develop from local causes, leaving the general configuration of the patient normal, but suggests that these should be designated by the word dislocation or prolapse with the name of the organ affected.

Diagnosis may be effected by observing the general figure of the patient, and by percussion, auscultation of the splashing sound, the feeling of the floating tenth rib,

and by the picture shown by the *x*-ray. The *x*-ray investigations of Rosenfeld, and Groedel have, in the author's opinion, given a wrong conception of gastropotosis, leading to the erroneous view that a dilatation of the pyloric portion of the stomach is always present. In this Hemmeter disagrees with Elsner who teaches that a gastropotosis involves a dilatation of the organ. Hemmeter refers to the splendid illustrations given in Riegel's *Diseases of the Stomach* which show prolapsed stomachs situated at or below the navel, not only without any dilatation whatever, but actually very small in size.

[One needs merely to examine the form of the normal stomach as shown by the *x*-ray and compare it with the form of the gastropototic stomach to perceive that the lower part of the stomach, the pyloric portion, has yielded probably to the weight of the ingesta, so that an actual dilatation has occurred, although the stomach may still be capable of emptying itself.—S.]

Hemmeter has published measurements of the thorax and abdomen of 1,125 splachnopototic patients. The measurements which he recommends are those seen in the following table which gives the dimensions of these measurements in 810 cases of females and 315 males, thus indicating the figures that may be expected.

COMPILATION OF 810 CASES FEMALES (ABBREVIATED)

Anthropometric proportions in relation to enteropotosis. (Female.)	HEIGHT									
	5 ft. 3 in.	5 ft. 4 in.	5 ft. 5 in.	5 ft. 6 in.	5 ft. 7 in.	5 ft. 8 in.	5 ft. 9 in.	5 ft. 10 in.	5 ft. 11 in.	
Manubrium to xiphoid...	17 $\frac{1}{2}$ ₁	19	18	18	19	19	20	21	21	
Manubrium to umbilicus.	32 $\frac{1}{2}$	32 $\frac{1}{2}$ ₁₁	33	33	34	34	35	36	38	
Manubrium to symphysis	49 $\frac{1}{2}$	50 $\frac{1}{2}$ ₁₁	54	53	52	53	53	54	56	
Xiphoid to right superior spine of ileum.....	27	25	28	28	27	29	30	30	30	
Xiphoid to left superior spine of ileum.....	26 $\frac{1}{2}$ ₁₈	27	27	28	27	28	31	30	29	
Right to left anterior and superior spines of ileum	25 $\frac{1}{2}$	25	28	27	27	28	30	30	30	
Circumference at xiphoid	68 $\frac{1}{2}$	68	67	66	67	70	71	73	74	
Atlas to 5 lumbar vertebra	58 $\frac{1}{2}$	56	66	65	66	69	70	71	72	
Height in centimeters....	160.0	162.5	165.0	167.6	170.1	172.7	175.2	177.7	180.3	
Weight in pounds	125 $\frac{1}{2}$	121	119	125	125	135	144	150	150	
Infrasternal angles in degrees. (Normal, 80.2°).	68	68	69	69	70	70	72	73	73	

COMPILATION OF 815 CASES OF MALES (ABBREVIATED)

Anthropometric proportions in relation to enteroptosis. (Male.)	HEIGHT									
	5 ft. 8 in.	5 ft. 4 in.	5 ft. 5 in.	5 ft. 6 in.	5 ft. 7 in.	5 ft. 8 in.	5 ft. 9 in.	5 ft. 10 in.	5 ft. 11 in.	
Manubrium to xiphoid ..	19	20	20	20	21	22	23	23	24	
Manubrium to umbilicus.	34	34	34	35	36	36	38	38	39	
Manubrium to symphysis	50	52	53	53	54	54	56	57	59	
Xiphoid to right superior spine of ileum	28	28	28	29	29	30	31	32	32	
Xiphoid to left superior spine of ileum	27	28	27	29	30	30	30	31	32	
Right to left anterior and superior spines of ileum	28	27	28	28	30	30	30	31	32	
Circumference at xiphoid	72	74	76	76	77	78	80	79	80	
Atlas to 5 lumbar vertebra	69	70	70	71	73	73	75	75	76	
Height in centimeters.....	160.0	162.5	165.0	167.6	170.1	172.7	175.2	177.7	180.3	
Weight in pounds.....	181	183	183	140	146	150	150	170	170	
Infrasternal angles in degrees. (Normal 84°)...	69	70	71	72	73	73	74	75	75	

The measurements are in the metric system.

Hitherto there has been but one mathematic index proposed for enteroptosis, the Becher-Lennhof index for asthenia universalis congenita. This is obtained by dividing the distance from the jugulum to the symphysis pubis by the smallest circumference of the abdomen and multiplying the result by 100. It is a purely empirical procedure and has given no results that could be called even approximately reliable. The elongation of the thorax in splanchnotosis frequently produces a marked displacement downwards of the thoracic organs, the heart tending to become pendulous, the esophagus elongated. Hemmeter uses largely in place of the Becher-Lennhof index the angle of the lowest ribs with the sternum which he calls the infraxiphoid angle.

Effects of Splanchnotosis. The consequence of obstruction to venous return in organs that are decidedly misplaced is a continual passive congestion. In Hemmeter's opinion this chronic hyperemia is the principal cause of the frequent catarrh of the stomach, intestine and colon.

Nephroptosis. The most exaggerated circulatory disturbances that are met with in this condition are found in extreme cases of dislocation of the kidney—nephroptosis—where the vessels may actually be twisted off, so that we can find cases of floating kidneys recorded where

the ureter was completely obliterated by a kink or twist, and where even at the operation the renal vein appeared to be almost obliterated. Where such conditions as these exist, the only hope of relief comes from replacing the organ in its normal position, and in such cases a surgical procedure to fix the loosened kidney may be a life-saving measure. Fortunately, the necessity for surgical treatment is rare even in kidney dislocations, of which various degrees must be differentiated—namely, (1) the palpable, (2) the movable, (3) the floating kidney. For dislocation of the stomach and colon, surgical operation is exceedingly rarely called for; and, in those cases in which operation was undertaken, in the writer's experience the symptoms did not disappear, and an alarmingly large proportion of the operated cases gave later evidence that the organs had again detached themselves from the location in which they had been artificially fixed. A treatment which aims at fattening of the patient has given more satisfaction to the patient and more permanent relief than any of those which he had operated.

Pathology and Causation. The condition, being congenital, is necessarily a persistence of an embryonic state as Rosengart claims. It is incorrect to refer the support of the abdominal organs solely to the ligaments as Weisker does, for the liver is too heavy to be held in place by its ligaments alone and its support must be mainly referred to negative abdominal pressure. Open an abdomen at necropsy by a small hole and through it insert the hand and forearm and attempt to pull down the liver by grasping the vessels on the under side of the liver and it will be found that all the strength of an average man will not suffice to do it providing that the subject is normal and has not had enteroptosis. Hemmeter thinks that the abdominal muscles alone are insufficient to create this negative pressure, but attributes great force to the action of the muscles of respiration, including the diaphragm, which maintain the negative pressure which keeps the abdominal organs in position. The physiologic tonus of the organs plays a large rôle in maintaining the normal position of the viscera, but Hemmeter gives little credit to the theory of Zweig who

ascribes splanchnoptosis to a hypertonicity of the vagus.

C. L. Green⁷ gives a description of Stiller's *asthenia universalis congenita*. In addition to the floating tenth rib he calls attention to the general structural stigmata which are even more interesting. These he classifies under several heads: Outward signs, the heart and blood-vessels, the lungs, the stomach, the intestines, the blood, the kidneys and the nervous system.

Gastric Contents in Gastropotosis. From an examination of the gastric contents in 40 cases of gastropotosis T. R. Brown⁸ arrives at the following conclusions:

1. While in individual cases of gastropotosis one may meet with varying amounts of free hydrochloric acid, ranging from a condition of achlorhydria to one of hyperchlorhydria, nevertheless the tendency in the majority of these cases is towards a distinct diminution of the free acid.

2. The extent of this diminution is dependent upon the amount of downward displacement of the stomach, the diminution being slight in the cases of slight descensus, very marked, with a tendency to complete disappearance, in cases where the ptosis is very great.

3. The fact that so many of the patients with marked ptosis show a complete absence of free hydrochloric acid suggests that gastropotosis may be one, if not the most important causative factor of achylia gastrica (so-called). That this achlorhydria is functional in a large proportion of these cases is shown by the fact that under the appropriate treatment, overfeeding, a proper dietary, rest at appropriate times, the wearing of a suitable support, and postural treatment in conjunction with the administration of hydrochloric acid by mouth there is usually a return of the free hydrochloric acid after the test-meal, although it may require persistence along this line of treatment for many months before this occurs.

Blood-Pressure Observations in Patients with Relaxed Abdominal Muscles. There is considerable difference of opinion as to the effect of the horizontal position on blood-pressure. A number of authors found an increase on standing while others found it diminished.

(7) N. Y. Med. Jour., May 13, 1911.

(8) N. Y. Med. Jour., Sept. 16, 1911.

F. W. Birtch and T. G. Inman⁹ have observed the blood-pressure in order to determine the effect of posture in cases of enteroptosis with relaxed abdominal musculature. They give the following summary from their observations:

1. It may be normal to have a slight systolic fall on standing after lying in healthy individuals who are not undergoing active muscular training.

2. Patients with relaxed abdominal musculature and enteroptosis, not showing subjective symptoms, will be found to have at least the diastolic sustained in change of position, and it may be assumed that the vasomotor mechanism is competent.

3. Patients with relaxed abdominal musculature and enteroptosis with circulatory symptoms will show both a systolic and a diastolic fall on standing after lying.

[Blood-pressure taken from the arm of the average normal adult is higher in the recumbent than in the erect position. The pressure taken upon the thigh or leg is higher in the standing than in the recumbent position.—B.]

4. The neuropathic symptoms found in these cases are not due to the malposition of the viscera nor can they be placed among the neuroses. They are entirely dependent on the cerebral anemia.

5. The circulatory changes, while the cause of the symptoms, are not the primary etiologic factors, but are second to the great muscular atony, the cause of which is yet unknown.

Enteroptosis in Children. R. R. Smith,¹ from a study of enteroptosis in children, concludes as follows: The enteroptotic habit of adult life finds its counterpart in the frail child presenting the same fundamental characteristics: Frailness, lack of fat, slenderness of muscle, lack of vigor in body development. Any actual collapse of the thorax or diminution in the capacity of the upper abdomen is seen only in older children, and then only exceptionally, even in frail subjects. The muscular insufficiencies of later life in enteroptotic women are common in frail children. The prolapse of kidneys, stomach, colon and intestines which accompanies the

(9) Jour. Amer. Med. Assoc., Jan. 27, 1912.

(1) Jour. Amer. Med. Assoc., Feb. 10, 1912.

enteroptotic habit of adult life is not outspoken in childhood (under 12 years) except in rather rare instances, and then usually late in that period.

In Smith's opinion, the habit itself is of far greater importance to the enteroptotic woman than the prolapse of the viscera which accompanies it; at least, in the vast majority of instances. Her lessened ability to fulfil the duties imposed on her, the limitations placed on her by her lack of vigor and the unhappiness which such women in a state of fatigue endure are serious matters with her. More might be done in the way of prevention. The frail child should be more clearly recognized as an entity and its tendencies more intelligently fought. In a large number of instances it is possible to maintain a fair state of nutrition in such children and to direct them to a more vigorous womanhood. When this is uniformly done, we shall have accomplished much and shall do away, to a certain extent, with the enteroptotic, neurotic women, who form such a problem in every-day practice and in almost every specialty.

Treatment of Splanchnoptosis. G. W. McCaskey² describes a modification which he has devised of the adhesive plaster bandage of Rose. A strip of zinc oxid adhesive plaster 2 or 2½ inches wide and about 5 or 6 inches long, the length varying with the size of the patient, is placed transversely across the extreme lower abdomen as nearly as possible to the pubes, the hair having been shaved clean for this purpose. To each end of this strip of adhesive plaster is attached a bandage of about the same width, long enough to reach around the body above the iliac crest, and to be tied or otherwise fastened behind, or better, one end long enough to reach around and fasten at the opposite end of the plaster. If the ends of the plaster have a tendency to become loosened and to pull up by traction of the bandage, this can be prevented by a narrow vertical strip across each end of the adhesive strap and applied to the skin above and below. The bandage itself is well padded with cotton, either folded within it or applied to the body immediately beneath it. This prevents any irritation of the skin from the bandage and permits of its being drawn

(2) Jour. Amer. Med. Assoc., Oct. 28, 1911, reproduced by Google

as tightly as necessary in order to furnish the necessary support from below. If it is a little too tight, it can be easily adjusted and can be entirely relaxed at night if thought advisable, although it is better to maintain some support during the night as well as during the day. The great difficulty with the adhesive straps carried entirely around the body, is that if they are applied somewhat too firmly they cause irritation, and the difficulty of removal complicates their management very much. By means of this fixed point of support in the lowest zone of the anterior abdomen, the pressure is applied exactly where it should be and does the greatest possible good. Altogether, it has given better results with less

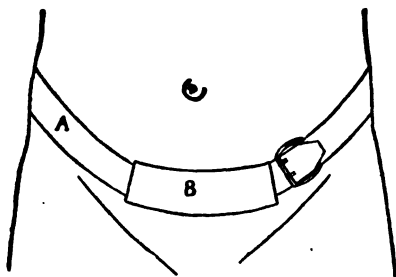


Fig. 16.—A device for the mechanical treatment of Glenard's disease. A, indicates double-padded bandage; B, zinc oxid strip.

annoyance and is more easily managed than any mechanical appliances McCaskey has ever used. (See Fig. 16.)

In treating gastropotosis we should aim at restoring the state of tonus as well as replacing the prolapsed organ. For this reason the attempt should be made to improve the patient's central nervous system by general hygienic measures. For immediate amelioration of symptoms an abdominal support is of most benefit. H. W. Soper³ recommends a modification of Rose's adhesive plaster bandage which consists in the use of narrow 2-inch strips. The pubic hair is thus avoided, and much less surface is covered than with Rose's bandage, making the patient more comfortable and giving more freedom of motion. (See Fig. 17.)

The bandage is applied as follows: The patient sits on a couch, and the adhesive strip is fastened to the dorsal vertebrae and follows the right lower rib margins. The patient now lies down; then the lower abdominal contents are pushed upward with the operator's left hand while the bandage is carried across the abdomen and attached to the left side at Poupart's ligament. The patient again sits up and a second strip is applied to the other side in exactly the same way as the first one. Finally a third strip is attached across from one superior iliac spine to the other, the patient lying down. The bandage can be worn comfortably for two weeks. Bathing is not interfered with. It is easily removed by gasoline or oil of wintergreen and may be reapplied imme-

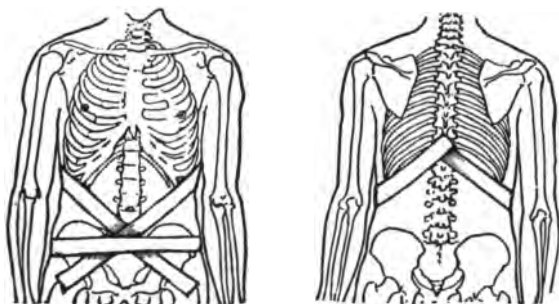


Fig. 17.—Sketch showing mode of application of Soper's modification of Rose's plaster bandage.

diately, or if the skin is irritated it may be left off for a few days.

Special exercises of the abdominal muscles, accompanied by proper breathing, must be at once instituted. The diet should be as nutritious as possible, but in no class of cases is more individualization required. The food should be adapted to the patient's digestive powers. The common practice of overfeeding with albuminous foods is often deleterious, as many of these patients are particularly liable to proteid intoxication. In gastric atony but little liquid should be taken with the meals. Cold water should be drunk on arising and several hours after eating.

For the constipation, which is usually present, diet, enemata of oil, agar-agar and the formation of a regular habit, are our chief reliances. Cathartics upset the peristaltic rhythm and should be avoided.

The indications for surgical intervention are extremely narrow; in fact, strictly speaking, there exists no rational operative treatment for simple enteroptosis. Should a prolapsed kidney become diseased the indications are of course changed accordingly; or should inflammatory processes cause adhesions and kinks with resulting obstructions and hindrances to the passage of contents, surgery becomes a necessity.

APPENDIX DYSPEPSIA.

F. W. Cheney,⁴ in discussing appendix dyspepsia, describes three classes of cases: In the first class, as regards the dyspeptic history, there is no one definite picture presented in all cases. Moynihan in his original paper called particular attention to the striking resemblance of many histories to that of gastric ulcer; the symptoms being pain soon after food, epigastric in location; flatulence and belching; sour eructations; nausea and frequent vomiting; even hematemesis at times. He says: "The typical gastric ulcer of the medical textbooks, in my view, is frequently the appendix."

In the second class of cases the history is that corresponding to hyperchlorhydria: persistent heartburn, water-brash, flatulence, nausea, but without pain or vomiting or hematemesis. This group is undoubtedly a common one; but as hyperchlorhydria does not often produce symptoms severe enough to lead the patient to submit to operation, the source of the trouble is not so frequently demonstrated as in the supposed cases of gastric or duodenal ulcer.

In the third group of cases the complaint is of heaviness and fulness and discomfort soon after eating, with flatulence and belching and frequent regurgitation of mouthfuls of food during digestion; and of inability to take as much food as desired, because the stomach soon feels overdistended. These cases may show a normal

(4) Interstate Med. Jour., October, 1911.

stomach analysis or a subacidity, and seem to be due not so much to secretory disturbance as to pylorospasm. Moynihan mentions such cases in his report. The writer has also observed one case of this sort. A woman, aged 40, complained that she had had stomach trouble off and on for twelve years, but had been fairly well until a year before. Since then she had much bloating and fullness after food; also, while she had no pain after eating, within five minutes, no matter how much or how little was taken, the food began to come up in mouthfuls. This happened after every meal, but as a rule only a few mouthfuls came and then no more, though exceptionally this would go on for hours. It was not water-brash but solid food that was regurgitated, without nausea or any effort at vomiting. The bowels were persistently constipated. This patient never showed any evidence of organic disease in her stomach—no tumor, no tenderness, no dilatation, no food retentin, no peristaltic wave; and though numerous analyses were made, the secretion was always practically normal. But, at the first examination and all subsequent ones a mass was palpable in the appendix region, not tender to touch as a rule, but always causing discomfort when handled. Medical treatment of all sorts did no good. Even the rest cure, on the theory that the dyspepsia was neurotic, made no change whatever in the symptoms. Finally after several months the abdomen was opened and the appendix removed. It was found bound down and buried by adhesions throughout its entire length. Following this procedure the old symptoms at once disappeared, and though more than a year has now elapsed, the patient has remained perfectly well.

First, inquiry as to a previous attack of appendicitis should be made, but a previous history of disease of the appendix is not always obtained, although previous vague attacks of abdominal disorder may be recalled.

Secondly, we have to ask whether there are any typical findings on physical or laboratory examination that aid in the recognition of appendix dyspepsia. Although the symptoms are entirely gastric, the physical examination gives none of the signs usually found in organic disease of the stomach, except epigastric tenderness,

which may or may not be present. There is no tumor visible or palpable; no peristaltic wave indicative of pyloric obstruction; and no decided change in contour after inflation, such as is found in prolapse or dilatation. Investigation of stomach contents after a test-meal gives variable results. Hyperacidity is common; but on the other hand the acidity may be normal or subnormal. Fenwick says that chronic hypersecretion is a frequent finding, as shown by the presence of hyperacid juice in considerable amounts in the fasting stomach in the early morning. But there is no food retention to indicate organic obstruction at the pylorus and no excess of mucus as in chronic inflammation.

With this comparative lack of evidence of organic stomach disease, there is on the other hand more or less evidence presented of trouble with the appendix. In the first place, there may be a palpable mass there, rolling freely under the examining hand, tender on pressure; or there may be simply extreme tenderness without palpable thickening; or when pressure is made at McBurney's point, the patient may complain only of pain in the epigastrium, or of epigastric distress and nausea. Even when chronic appendicitis is present, it is possible that no local signs may be elicited, or that they may be discovered at one examination and not at another, so that the failure to find them does not eliminate the presence of a diseased appendix.

Thirdly, the question naturally follows, Is it possible so to combine history and physical signs as to diagnose dyspepsia due to chronic appendicitis? Of the first importance is a careful clinical history of past illnesses as well as of the present one, for so a clue may be obtained as to whether appendicular attacks have preceded. In all digestive disturbance more is to be learned from the character and sequence of the symptoms than from physical examination; and time taken to collect and to arrange the details of the patient's story is time well spent.

It is in cases of apparent gastric ulcer that this possibility should always be remembered and the appendix carefully examined before operation is done or before medical cure is instituted for ulcer. Even if treatment

by rest and restricted diet removes all symptoms for the time, it does not follow that the pathology was in the stomach; for such treatment would also relieve the strain upon an inflamed and adherent appendix. There are points, too, in the clinical history of ulcer that ought to differentiate it from the other forms of chronic indigestion, if the case is carefully studied. Such are the long duration and the alternation of periods of distress with periods of comfort; the onset of the symptoms of pain, distress, sour eructations, nausea and vomiting one to four hours after food; and the relief afforded by taking food or drink or alkalies. Graham emphasizes these latter points particularly. He says it is not the chronicity of the indigestion that is peculiar in ulcer, it is not the degree or location of the pain, nor the occurrence of vomiting, gas, sour eructations or burning discomfort in the stomach; these details are common to many types of chronic dyspeptic trouble—gall-stones, appendicitis, cancer; but the characteristic point is the time the pain appears, with its accompanying symptoms of vomiting, gas and sour eructations; its regularity after meals; and its control by food, vomiting and alkalies. In chronic appendicitis, on the contrary, the time of onset of pain is irregular. It usually appears soon after food and often is present continuously, regardless of food, though in the epigastrium, and not over the appendix. There is not the definite regularity of symptoms after every meal; and nausea, distress, flatulence and distention are more common than severe pain. Finally, the symptoms in chronic appendicitis are not controlled by taking food, which usually disturbs rather than relieves; while vomiting is not so constant and does not give ease if it occurs; and alkalies have no effect at all. But after all is recalled about these fine points in differential diagnosis, it will be well to remember also the rule laid down by Paterson—"in all operations for supposed gastric ulcer, the condition of the appendix should be carefully investigated."

Fourthly and finally, how does removal of the appendix cure the gastric symptoms? It has been claimed by skeptics that the cure is the result simply of suggestion; that the dyspepsia is neurotic and that the removal of the appendix has not so much to do with ending the

symptoms as has the psychologic influence of the operation itself. This explanation of the cure has been discussed by Ewald, who refuses to accept it for the following reasons: (1) None of the patients coming under his observation were hysterical; they had become nervous from prolonged suffering, but could not be looked upon as being from the beginning hysterical or neurasthenic persons; (2) suggestive effects are never of long duration; they may be surprising but they do not last; while in his cases the cure was permanent, in some of them continuing after as much as ten years; (3) there are patients operated upon for typical attacks of appendicitis, who besides complain of pains not due to the appendix, and in such persons the latter complaints remain after operation, depending on coincident disease elsewhere.

It seems perfectly clear to those who have observed cases, whether few or many, that the removal of the dyspepsia is directly due to the removal of the appendix; and a rational explanation for this is not hard to find. The chronic inflammation in the appendix leads to adhesions that bind it down to the cecum; or to obstruction of its lumen so that its cavity contains concretions or thick, offensive, purulent fluid. The presence of these abnormalities leads reflexly to protective spasm of the pylorus or to a continuous hypersecretion of gastric juice, and the removal of the cause produces a cessation of the effects. Within the last few years physiologists have proved conclusively that the various parts of the gastro-intestinal tract are mutually dependent one upon the other; and it is not surprising that disease of one part such as the appendix, should have an influence upon another such as the stomach. Let us then have faith when reason gives so good a basis for it, and in the future let us not hesitate to diagnose appendix dyspepsia when the evidence warrants, or to advise operation when the diagnosis is made.

DISEASES OF THE COLON.

Anomalies. In discussing the anomalies of the colon as revealed by the x-ray C. Eastmond⁵ summarizes them

(5) Long Island Med. Jour., 1911.

as follows: 1. General prolapse of the transverse colon producing the "U" or "V" type. 2. Prolapse of the hepatic or splenic flexure with or without angulation. 3. Angulation of any part, especially of the sigmoid. 4. Prolapse of one-half of the entire colon. 5. General prolapse of the entire colon into the pelvis. 6. Spasm of one part or of the entire colon. 7. Anomalous development of any part, such as a loop formation from the presence of an unduly long mesentery. 8. Adhesions, either alone or associated with any of the above conditions.

In all these conditions, there is some factor which is sufficient to produce partial obstruction and damming back of the fecal stream. In the cases of adhesions and angulations, there is almost uniformly found a dilatation behind the obstruction. This, with the ensuing stasis, affords ample opportunity for undue absorption of intestinal material—auto-intoxication, with its headache, drowsiness, listlessness, etc. With prolapse, the displaced portion of the viscus, by dragging on its natural supports, is productive of backache, and with the interference in circulation and innervation, there follow congestion, inflammation, spasm, local pain and tenderness, and that train of nervous phenomena which is termed neurasthenia.

Colitis Caused by Mercury. As a result of extensive experimental studies H. Cobliner⁶ sums up his findings as follows:

1. Mercury circulates in the bloodvessels as albuminate of mercury and is excreted into the intestines. Toxic symptoms occur when the mercury ions become free. The ingestion of sodium chlorid in large amounts increases the splitting off of mercury ions and raises the toxicity of mercury.

2. By an increase of the molecular concentration, that is of the osmotic pressure, there is produced an osmotic irritation in the intestine. This osmotic irritation increases the amount and rapidity of the excretion of mercury by the intestine.

3. The excretion of mercury from the blood into the large intestine is effected by the excretory power of the

(6) *Archiv f. Verdauungskr.*, Bd. 17, H. 4.

latter. It can be increased by irritating agents and checked by paralyzing remedies.

4. The changes produced by mercury are most marked in the ascending colon. Putrefactive processes which are more decided in this portion of the intestine than in other parts co-operate in the production of these lesions. The intact intestinal wall remains unaffected by putrefactive processes but if it is injured by the excretion of mercury it undergoes the pathologic changes which have been referred to.

Treatment of Chronic Colitis. J. R. Verbrycke⁷ gives the following hints as to the treatment of chronic colitis: At night plain liquid petrolatum in doses of from one to three tablespoonfuls is the most valuable preparation. It is tasteless and goes through the digestive tract unchanged, simply acting by mechanical lubrication. Other medicines may be given for special indications when necessary. One of the methods which has proved most useful to the author in combating subacute exacerbations is the injection of hot 10-per-cent. gelatin solution lately advocated by von Aldor. A cleansing enema is first given, followed in an hour by the injection of the gelatin solution at a temperature of from 112° to 120° F.; 50 to 100 c.c. are given with the patient lying on his left side, after which hot compresses are applied to the abdomen and the patient kept quiet for a couple of hours. This should be repeated daily for a while, and then every other day.

Spontaneous Mobility of the Colon. T. Hausmann⁸ discusses the subject of mobility of the colon in its relations to the palpation of the intestine and the diagnostic and therapeutic results obtained by palpation and massage. He claims that a colon which hangs down in an arc may take a straighter position by its own force and spontaneously, a phenomenon which can be determined in some cases by long and repeated examination by means of palpation. The spontaneous mobility and change of course in the colon must be admitted as proved. This phenomenon must be referred to the following causes:

(7) Virginia Med. Semimonthly, Oct. 27, 1911.

(8) Deutsche med. Wochenschr., Mar. 7, 1912.

1. A varying degree of fulness of the intestines with gas may cause an increased bending and sinking or a stretching and lifting of the transverse colon. What is true of fulness with gas holds also for fulness with a liquid as can be seen in the case of enemata into the colon. By palpation a change in position of the colon can be not infrequently observed after inflation or after enemata.

2. The action of abdominal pressure affects the position of the intestine in the sense of a sinking when it is relaxed.

3. The descent of the transverse colon may be occasionally determined by palpation after the act of defecation. This has also been observed with the Röntgen ray by Hertz.

4. In the presence of hernias a change of position of the colon may be observed in proportion to the degree and the presence or absence of the hernia. This has been experimentally determined by Kelling.

5. The most important and most frequent factor depends on muscular contraction. According to Exner the contraction of the intestinal musculature affects not only the caliber but also the length of the intestine. As the result of a uniform contraction of the longitudinal muscular layer there occurs, according to Exner, a shortening of the intestinal tube and an increase of the lumen. Uniform contraction of the circular muscular fibers produces not only a narrowing but also a lengthening of the tube, while the simultaneous contraction of both layers occasions a shortening of the tube with a simultaneous narrowing of the lumen and thickening of the intestinal wall.

Massage of the large intestine is of value only when we are sure that we are actually massaging the large intestine and not simply sliding along it. The usual massage in the region of the large intestine is of no value. There must be maintained during massage a palpatory feeling of the intestine, and that is obtained by means of the palpatory massage employed by the author. This method involves as a necessary condition the process of methodical palpation of the large intestine whose fundamental principle depends on the rule of Obrastzow to

execute gliding movements transversely to the axis of the intestine. The author concludes as follows:

1. With the help of topographic gliding and deep palpation one can study many peculiarities in the large intestine which remain unnoticed under the ordinary methods of palpation. Many of the facts ascertained by the author by palpation have afterwards been confirmed by the Röntgenologists.

2. The spontaneous mobility of the colon must be kept in view both in massage and in the confirmation of the facts learned by palpation. The spontaneous mobility of the colon robs the control-tests of the position learned by palpation by means of inflation, Röntgenoscopy, or autoscopy of a great part of their absolute value.

3. The best method of massage of the large intestine is the palpatory.

4. By massage of the large intestine movements of the contents can be obtained only when the massage is carried out in a palpatory manner and with sufficient force.

Sigmoidoscopy. Dudley Roberts⁹ believes that sigmoidoscopy should be an important work of the gastroenterologist. He has made it a routine part of the examination in cases of disturbed function of the bowel and others in which it is indicated. In this instrument, the obturator is much more olive-shaped than in other forms of the sigmoidoscope and proctoscope. It is a foolish idea that obturators must be made rounded, because it is dangerous to shove anything with a sharp point into the bowel, for the instrument is not introduced any further than the anus. There is in this sigmoidoscope a side tube, carrying a small light, the light-holder being standard in all instruments. The rays are passed down, and, by reflection, become parallel. At the proximal end of the instrument, there is a window, which is screwed on. The glass is the full size of the lumen of the tube. Therefore, there is no obstruction whatever to the view. There is another small tube for connection with the rubber dilating bulb. It is surprising what a bright light one can get with this instrument, and it apparently works as well in a tube of small caliber as in one of larger caliber. The light is thrown two or three inches

(9) Boston Med. and Surg. Jour., June 1, 1911.

from the end of the tube, which is as far as the curve in the bowel will allow one to see. The instruments are made in four sizes.

CONSTIPATION.

Etiology. Prostatic Enlargement. J. M. Anders¹ calls attention to the frequency of constipation in old men suffering from enlargement of the prostate, which he believes has not been sufficiently emphasized as an etiologic factor. In addition to its direct mechanical action prostatic enlargement may cause swelling of the hemorrhoidal veins with a tendency to obstruct the motion of the bowels. It is quite probable that the prostatic irritation which often accompanies the hypertrophy is communicated to the rectal mucosa, producing a drying effect upon the bowel contents which are obviously lacking in moisture in these cases. The feces often consist either of dry, hardened, sausage-like masses diminished in diameter or of small scybalous masses.

The author has met with constipation due to hypertrophy of the prostate in subjects who were less than 50 years of age. It is claimed by some that this disease may have its inception as early as the fourth decade of life. In such cases the constipation seems to develop *pari passu* with the exceedingly slow and gradual increase in size of the gland. In some cases the patient is conscious of obstructive symptoms and even experiences sensations suggestive of a mechanical impediment to the transit of the bowel contents through the rectum.

The diagnosis is made by determining the existence of an enlargement of the prostate on the one hand, and on the other, by excluding or giving due weight to all other causes for this condition. Again the commonest of all sorts of constipation, namely weakened bowel muscles, due principally to lack of exercise and viscerop-tosis should not be omitted from consideration but should be carefully weighed. If multiple diagnosis must be made in a given case, then a proper sequence in development of the pathologic states must be determined after a critical analysis of the symptoms from the beginning.

(1) Amer. Jour. Gastro-Enterology, April, 1912. Digitized by Google

The most effective method of overcoming this variety of constipation is by softening the feces by means of an enema consisting of sweet oil. This is to be injected slowly into the rectum through a piston syringe each evening on retiring and retained until the next morning. Less effective although more convenient are soap and especially glycerine suppositories. Among ameliorating measures massage is recommended in the early stages, carried out by especially trained masseurs, and its effects carefully noted by the attending physician at frequent set intervals. Palliation, however, should not be allowed to postpone a suitably indicated operation.

Coloptosis. L. J. Hirschman² calls attention to the importance of coloptosis as a cause of constipation and advises radiographic diagnosis and appropriate operative measures. Some cases of distention of the sigmoid, ptosis and more rarely distention of the transverse and ascending colon, are secondary to obstipation caused by mechanical obstruction in the rectal region, the principal causes here being hypertrophied rectal valves, acute angulation of the anus, rectum or sigmoid. The local relief of these conditions by valvotomy, meso-sigmoidopexy or excision of prolapsed mucous membrane, followed by daily rectal and sigmoidal massage by means of the author's pneumatic rectal massage bag, will give prompt and lasting relief.

In conclusion, in all cases of constipation, whether the radiograph shows them to be coloptotic or not, one should give the patient the benefit of the doubt and use every approved method of treatment, whether dietary, physical, mechanical or medicinal, before resorting to surgery for its relief. When other methods have failed and the case proves to be coloptotic constipation, then, whether the operation be a mesenteric suspension, a plication or an anastomosis, the use of mechanical measures as well as the outlining of a proper dietary and a regulation of the patient's habits, should constitute just as important an element in the treatment of the case as the operation.

Symptomatology. Intestinal Vertigo. M. Loeper³ describes the vertigo of constipated persons which may

(2) *Memphis Med. Monthly*, March, 1912.
(3) *Sem. Méd.*, Aug. 23, 1911.

vary in degree from a slight lightness of the head and uncertainty of gait to the more severe form in which the patient must keep to bed. In the milder form it ceases on the evacuation of the bowels but in the graver forms it may disappear only after a course of treatment directed to the intestine. A number of causes may be assigned for this phenomenon. It may be a manifestation of general neurasthenia, or of poisons circulating in the blood, the source of the difficulty being referred to the intestine.

The variety of causes that may give rise to vertigo bring about a considerable uncertainty in treatment. During the attack the patient should be put to bed and the arterial pressure taken. If it is high a little nitrite of amyl should be inhaled. Mistletoe may be injected and a leech placed behind the ear. A rather strong purge will give good immediate results. If the arterial tension is low injections of sparteine, strychnine, ether, and the administration of bromids, and of valerian are particularly indicated.

Later treatment must be determined by the state of the intestine. Foods calculated to irritate the intestine, and large quantities of liquid should be avoided. Putrefaction, gaseous fermentation, aërophagia, and enteroposis should be met by appropriate remedies. Care should be taken not to depress these patients by a too strict or too debilitating diet. Their natural restlessness is exaggerated by too strict regulation, and they may easily become neurasthenic if they are not already so. Tonic measures for the general nervous system combined with sufficient rest to overcome undue excitement must form a prominent part of the treatment. Proper psychic measures should not be neglected.

Pathology and Treatment. A. F. Hertz⁴ divides the manifestations of abnormal action of the bowels as follows: Defecation may occur with insufficient frequency, the stools may be insufficient in quantity, or they may be abnormally hard and dry. To have one action of the bowels a day is often regarded as the only normal condition, but it is really nothing more than a question of convenience. It is indeed not very rare to find people

(4) *Liverpool Med. Chir. Jour.*, January, 1912. Digitized by Google

in perfect health who defecate regularly two or three times a day, and others who obtain an evacuation only once in two, three, or more days, without suffering the smallest ill effects. Such individuals, so long as defecation, when it does occur, is complete, can no more be regarded as diseased than those otherwise normal people whose hearts beat at a rate of only forty or fifty times a minute. The majority, however, although they may suffer no inconvenience for a considerable time, finally develop symptoms due to fecal accumulation, as defecation is generally incomplete as well as infrequent, so that gradually increasing quantities of feces are retained. For practical purposes, therefore, an individual may be considered constipated if his bowels are not opened at least once in every forty-eight hours. A less frequently recognized variety of constipation is that known as "cumulative constipation," in which insufficient feces are excreted, although the bowels may be opened every day, a condition analogous to retention of urine with overflow. Lastly, the amount of feces formed may be normal and the bowels may be opened daily, yet the feces are abnormally hard and dry owing to prolonged retention before excretion.

Hertz bases his classification of constipation upon the part involved in the disturbance, there being two forms: intestinal constipation and dyschezia where the delay is in the pelvic colon.

Constipation may be defined as a condition in which none of the residue of a meal, taken eight hours after defecation, is excreted within forty hours.

Intestinal Constipation. The average times taken, in normal individuals by the residue of a meal to reach the different parts of the colon are four and a half hours to the cecum, six and a half hours to the hepatic flexure, nine hours to the splenic flexure, and eleven hours to the commencement of the iliac colon.

The motor activity of the colon may be deficient owing to the weakness of the musculature, deficient reflex activity, inhibition, or uncontrolled and irregular action. Weakness of the musculature may be due to congenital hypoplasia, which is the cause of the constitutional constipation from which several members of

a family may suffer; acquired hypoplasia, which is the cause of senile constipation and the constipation which may follow such local diseases as dysentery; and functional insufficiency without structural change, as in chlorosis, acute fevers, and the cachexia of cancer and tuberculosis.

The reflexes, which maintain intestinal activity, may be deficient owing to the stimulation being too weak on account of lack of mechanical and chemical stimulants in the food or want of exercise. They are also deficient when the excitability of the mucous membrane of the colon is impaired as a result of catarrh and of long-continued irritation by purgatives. Lastly, constipation is a very frequent symptom of neurasthenia and hypochondriasis, as the depressed condition of the nervous system leads to a diminished response to the stimuli which normally excite intestinal activity.

Constipation may result from spasm, induced reflexly by the presence of an irritant in the colon of a patient, with an abnormally excitable nervous system. The nervous factor is shown by the neurotic temperament of most patients affected with spastic constipation and the frequent history of worry or overwork immediately preceding an attack, as well as by the good effect of belladonna, which diminishes the activity of the motor nerves to the intestines.

The work to be done by the intestinal musculature is excessive whenever the bulk or consistence of the feces offers more than the normal degree of resistance, and whenever there is any narrowing of the intestinal lumen. The feces may be abnormally bulky in big eaters who habitually bolt their meals, and in infants fed on a diet of undiluted cow's milk. Abnormal dryness and hardness may be due to an insufficient supply of water, excessive loss of water in the urine in diabetes, and in the sweat after hard exercise in hot weather, excessive absorption of water from the intestine, and deficient fat in the diet.

Dyschezia. In dyschezia, the second of the two great classes of constipation, the passage of feces through the intestines is normal or even unusually rapid, but the act of defecation does not empty the part of the bowel beyond the splenic flexure as completely as it should.

Hence, although the bowels may be opened daily, the feces become unduly hard owing to excessive absorption of water during their long retention in the rectum and pelvic colon, or cumulative constipation results from the slight daily deficiency in the quantity of feces excreted compared with the quantity produced. In severe cases defecation is not only incomplete but it does not occur daily, and finally it may become quite impossible to defecate without mechanical assistance.

Owing to the acute angle which the pelvi-rectal flexure normally forms, the further passage of feces along the colon is obstructed at this point. Consequently the pelvic colon becomes filled with feces from below upwards, and the rectum remains empty until immediately before defecation. In individuals whose bowels are opened regularly every morning after breakfast, the entry of feces into the rectum gives rise to the sensation of fulness, which leads to the desire to defecate and may be termed the call to defecation. The passage of the feces from the pelvic colon into the rectum is the result of active peristalsis in the former, brought about reflexly by various stimuli, the chief of which is the taking of food at breakfast into the empty stomach. The call to defecation is a result of the pressure exerted on the rectal wall by the feces on their entry from the pelvic colon, the urgency of the call depending upon the tone of the circular muscle fibers of the rectum at the time and the bulk and consistence of the feces. If a response is not at once made to the call, the desire to defecate passes away; this is due to the relaxation of tone, which occurs in the muscular coat of the rectum after it has been subjected to a certain degree of tension for a short period. The call to defecation returns only, after a further quantity of feces has entered the rectum and produced a rise in intrarectal pressure. This may occur after any meal, but most frequently only after breakfast on the following morning.

Dyschezia is due to a want of proper proportion between the power of expelling the feces from the pelvic colon and rectum and the force required to do this completely. It may, however, be due to inefficient defecation, or to an obstacle to efficient defecation such

as abnormally hard and bulky feces and functional and organic strictures of the rectum and anal canal. Dyschezia due to inefficient defecation is most, commonly the result of disregard of the call to defecation either on account of ignorance or laziness, or of fear of pain in diseases of the anus and the neighboring organs.

Dyschezia may be due to various other causes, such as weakness of the voluntary muscles of defecation, the assumption of an unsuitable position during defecation, and hysteria. But whatever the primary cause, the final result is the same. The incomplete evacuation of the rectum results in an accumulation of feces and consequent atony and dilatation of the rectum.

Hertz's observations have shown that the call to defecation depends not on the sensitiveness of the mucous membrane, for this is insensitive, but on the response of the muscular tissue to tension. Contraction will follow the moderate distention of a strong musculature, but if the muscle is atonic it will accommodate more feces before it will contract. Dyschezia is sometimes due to a congenital lack of muscle sense.

In the majority of cases the muscle sense develops when the infant grows older, but occasionally this may be the starting point of dyschezia, which lasts through life. The rectal muscle sense is abolished or defective in diseases of the spinal cord, in which the defecation center itself or the fibers connecting it with the brain are involved. This is the cause of the constipation which frequently occurs in organic nervous disease.

In addition to the two great classes of constipation already considered, there is a third which is due to the quantity of feces formed being insufficient to produce an adequate stimulus in the pelvic colon and rectum, and to a less extent in the colon. The passage through the small intestines in such cases is always normal; that through the colon is generally slightly delayed; but the main stasis is in the pelvic colon and occasionally in the rectum, as it may take several days before a sufficient bulk of feces has collected to produce the required stimulus. The insufficient bulk of feces is due to an inadequate quantity of food residue reaching the colon as a result of anorexia or esophageal or pyloric obstruction, or to

excessive digestion of food. The total weight of feces passed by constipated individuals is considerably less than that formed by normal people. This is not due merely to the greater dryness of constipated stools, but also to a diminution in the solid constituents of the feces. A remarkably small quantity of food *débris*, such as muscle fibers, starch cells, and vegetable membranes, is found in constipated stools, and the amount of nitrogen, fat, and cellulose, as well as the number of bacteria, in the feces is considerably less in constipated than in normal individuals. The diminution in water is due simply to increased absorption owing to the abnormally long period during which the intestinal contents are retained before excretion. In most cases this is also the cause of the diminished quantity of food residue and intestinal secretion, as both of these are likely to be absorbed during their prolonged retention in the colon. Sometimes, however, a diminution in the quantity of feces is due to an abnormally active digestion in the intestines, a condition which Goodhart has called *greedy colon*. This results in a deficiency in the culture media required for the growth of bacteria in the large intestines, as shown by the diminution in the number of bacteria in the stools; for this reason there is less production by putrefaction and fermentation of substances which normally act as stimulants to the intestinal movements.

In addition to the attempt to defecate in the early morning a call to defecation felt at any other time in the day should be observed at once. It is particularly important to impress upon young girls that no feeling of shyness should prevent prompt obedience to the call, at whatever inconvenient time it may occur. Sufficient time should always be spent over the act of defecation, as it is rare for a single effort to be sufficient to evacuate all of the accumulated feces.

In all cases of dyschezia, and in those cases of intestinal constipation in which the feces have become so hard and dry that a special effort is required for their complete evacuation, it is most important that a proper position should be assumed for performing the act of defecation. This is quite impossible with the

high seat of the majority of water-closets. A wooden footstool nine inches lower than the seat should therefore be provided.

In many cases it is necessary to eradicate fixed ideas, the presence of which interferes with natural intestinal action and defecation. The most common is the conviction that constipation will inevitably result if no artificial means are employed, so that the habit is established of using purgatives or enemata, although they are not really required. Thus, having found by means of the *x*-ray that a young man, who had been in the habit of taking large doses of vegetable and saline purgatives every day, was really not constipated at all when he was taking no medicine, he was persuaded on two consecutive mornings to open his bowels without a purgative, and he found he was cured.

The chief chemical stimulants of intestinal activity are sugars, the organic acids and salts of vegetable food, fats, the extractives of meat, and the products of the digestion and bacterial decomposition of carbohydrates, fats, and to a less extent, of proteins. The diet should, therefore, contain an increased proportion of fat and of vegetable foods, especially those which contain much cellulose, organic acids and sugar.

It is important that sufficient fluid should be drunk. In addition to that taken with meals, a glass of cold water should be drunk before breakfast, another half an hour before dinner, and a third just before retiring.

It might be supposed that the form of constipation which is due to a greedy colon required no treatment. But the occurrence of symptoms in severe cases makes it probable that the small quantity of feces formed is retained so long before sufficient accumulates in the pelvic colon to produce an effective stimulus to defecation, that an abnormally large proportion of its poisonous constituents is absorbed. It is therefore advisable to attempt to obtain an evacuation at least every other day. This can best be done by increasing the bulk of the feces by the administration of some unirritating substance, such as liquid paraffin which passes through the intestines without undergoing decomposition or absorption. Liquid paraffin is particularly valuable when the

feces are hard and dry; it is therefore useful in certain other forms of constipation besides that due to a greedy colon, as, for example, in diabetes. In dyschezia also the soft stools which result from its use are expelled with less difficulty than ordinary feces. From 1 dram to $\frac{1}{2}$ ounce should be taken with two or three meals every day. It occasionally gives rise to nausea, but on the whole is much more useful than agar-agar, which acts in a similar manner, but not infrequently causes disturbances in gastric digestion.

It is most important in treating dyschezia to keep the rectum and pelvic colon empty, so that they may in time regain their normal tone and contractile power. This can be accomplished only by the regular use of enemata of water or glycerine. The bulk of the water enemata and the strength of the glycerine enemata should be gradually reduced. As a rule the tone and contractile power slowly return and a cure finally results. In very exceptional cases the atony and paralysis of the rectum are so complete that recovery is impossible; in such cases treatment by enemata, though it does not cure, is the only way in which a regular evacuation can be obtained.

Cold applied to any part of the skin, but particularly to the abdomen, reflexly stimulates the muscular coat of the entire alimentary canal. Hence a cold douche after a hot bath is a very valuable addition to the series of stimuli which lead to the morning evacuation. The spasm in spastic constipation is often benefited by a hot bath, or by a hot compress applied to the abdomen. When constipation is due to some painful pelvic condition, the latter, and the associated spasm of the sphincter ani, may be relieved by the use of a hot sitz-bath.

Dyschezia is often associated with visceroptosis, both being due to weakness of the abdominal muscles. In such cases a proper support is of the greatest value. It has sometimes been taught that a support should be worn only when the abdominal muscles are so weak that their recovery is deemed unlikely, as it is supposed to cause atrophy of disuse of the muscles. This view is, however, erroneous; the support given to the viscera by a well-fitting belt or "visceroptosis truss" prevents

the abdominal muscles from being stretched; it consequently becomes possible for them to regain some of their former strength.

Treatment by Venous Injection of Peristaltic Hormones. A hormone is a chemical substance elaborated in the organism which, entering the blood, serves the purpose of stimulating the production of another secretion or arousing the function of a distant organ. One of the most prominent hormones is the peristaltic hormone obtained by Zuelzer from the substance of the spleen. In fact this organ is regarded as a storage place for the peristaltic hormone because it contains it in large quantities. The peristaltic hormone has the capacity of stimulating the peristalsis of the intestine. If used for therapeutic purposes this peristaltic hormone must be introduced intravenously or intramuscularly and its absolute sterility must, therefore, be made certain. The intravenous method is preferred. According to C. D. Aaron⁵ the use of the peristaltic hormone is indicated in atonic constipation, but in spastic constipation, where we have an overstimulation of the intestine its use is of course, irrational.

Zuelzer uses 40 c.c. of peristaltic hormone for an adult and 20 c.c. for children. The injection is made only once and the median vein is the best place for it. The skin is prepared aseptically and an Esmarch bandage applied on the upper arm to make the vein prominent. The fine needle of the syringe is introduced into the vein, the Esmarch bandage loosened and the contents of the barrel of the syringe are slowly forced into the vein. The needle is removed and a slight pressure with gauze is applied to the point of entrance. A small piece of adhesive plaster is then applied. Usually no reaction ensues. It is advisable to follow up the injection with one dose of castor oil. It serves as a lubricant while the hormone induces the normal peristaltic action. As against other remedies employed in chronic constipation, the peristaltic hormone has the superior merit that, having started evacuation, there is no need to inject more of it.

Henle, Saar, and Unger studied the action of the per-

(5) Jour. Amer. Med. Assoc., Feb. 10, 1912.

istaltic hormone in postoperative intestinal paresis, in the case of epileptics who had previously suffered from chronic constipation, and in the case of an almost moribund patient, with total intestinal paresis, with intestinal loops partly obstructed by inflammation, and proved that the peristaltic hormone is an innocuous substance. Several cases of ileus, in which intravenous injection of the peristaltic hormone was made in patients who were advanced in years, and who had some time previously been operated on, show that peristaltic stimulation produced by the hormone is not violent and causes no grave disturbances even if there is organic derangement and obstruction.

Zuelzer thinks that the peristaltic hormone may turn out to be also a means for differential diagnosis, for he cites a case of an aged man concerning whom it had been previously impossible to decide whether the constipation he was subject to was due to a volvulus, incident to an intestinal tumor, or to an obstruction of the intestine by the tumor. The administration of the peristaltic hormone, however, produced a visible peristalsis which could be demonstrated by auscultation. It is likely that further experiments will bear out Zuelzer's hope that a negative result after an intravenous injection of the peristaltic hormone may constitute a diagnostic proof of an organic stenosis or of the absence of a paralytic or dynamic ileus.

Saar, who reports three interesting cases of successfully treated chronic constipation, suggests that the injection be made in the early morning hours; he further suggests the use of a lubricant, that is, of an ample dose of castor oil. He calls attention, however, to the case of an old, arteriosclerotic patient, with accumulations of feces in the sigmoid flexure, which could not be dislodged by the treatment with the peristaltic hormone. Though both intravenous and intramuscular methods are followed by similar effects of a fairly painless character, Zuelzer and Henle prefer the intravenous to the intramuscular injection.

[In a considerable number of instances the use of hormonal has been followed by alarming collapse.—S.]

Treatment by Posture. J. Sawyer⁶ gives the following suggestions for the treatment of constipation: The best position of the body for the complete accomplishment of the act of defecation is the natural one, in crouching. In such a position only are the parts acting in the proper voidance of feces in the best position for doing it; the anus is in the best position for opening and the rectum for emptying its contents, all the muscles concerned in the act are in the best position for their efficient play, and the parts liable to injury from strain are guarded by their natural protections, certain hernial orifices, for example. Failure of defecation upon the usual seat will often at once issue successfully if the effort be renewed forthwith in the physiologic attitude.

Daily bodily exercise, especially out-of-doors and in the sunshine, favors defecational normality. In the successful treatment of habitual constipation further helps may well be given by exercises which promote biliary flow, such as developed respiratory movements by physical exercises which bring into play the muscles of the abdominal walls, and by such exercises as promote movement of those portions of the larger intestine in which fecal stagnation is most apt to occur, that is in the cecum and in the sigmoid flexures, for which last the psoas and iliac muscles must move well, as in running up stairs two steps at a stride, or as in "knees-up" exercises.

Treatment by Electricity. D. Luke⁷ reports 7 cases of chronic constipation treated with sinusoidal currents with uniformly beneficial results. He believes from his experience that there is no case of ordinary constipation, not of the spastic type, which cannot be cured by it, if only the patient will take the time necessary, which may run on to two or three months. Broadly speaking electricity is most useful in those cases where the intestine is atonic and the general innervation deficient. Luke urges a course of these electric treatments in any case of intractable constipation before submitting to the last desperate measure of excision of the colon so vigorously recommended by Arbuthnot Lane.

(6) Lancet, Sept. 16, 1911.

(7) Glasgow Med. Jour., June, 1911.

Sinusoidal or Polyphase Currents. In order to explain the nature of these currents as clearly as possible it will be well to deal, in the first place, with the production of a single-phase current. When a conductor is moved around a constantly varying magnetic field, E.M.F. is induced in that conductor, and if the circuit be completed a current will flow.

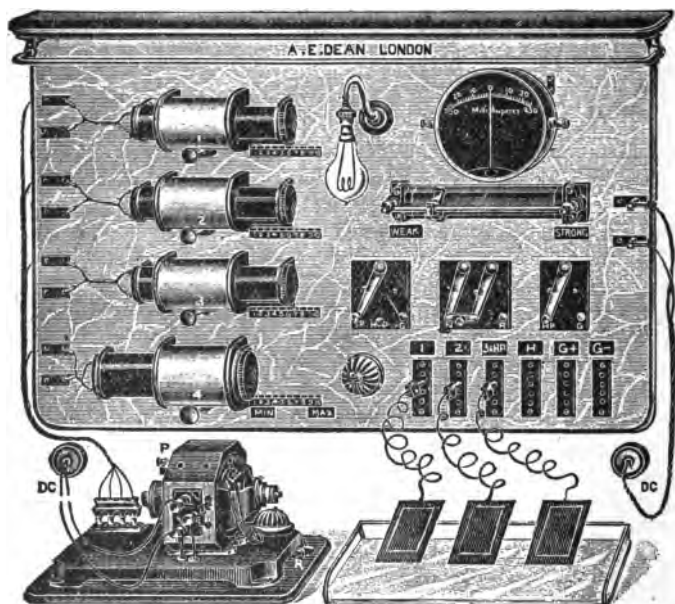
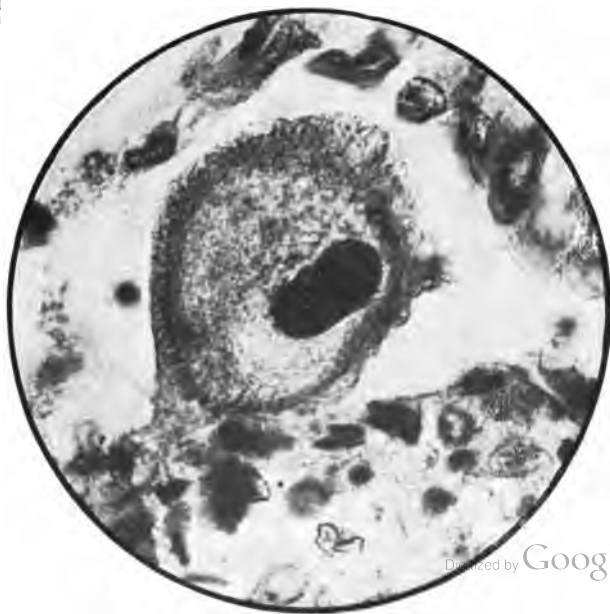


Fig. 18.—Herschell-Dean sinusoidal apparatus for direct current mains with complete control of tension and period.

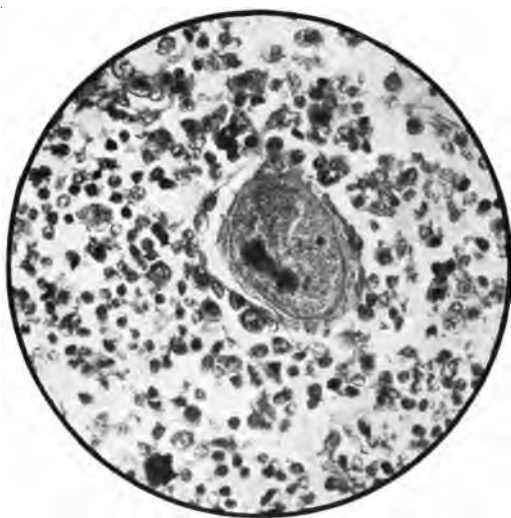
The best known application of this principle is the ordinary dynamo or electric generator. This consists elementally in a revolving armature carrying a conductor through the lines of force between the concave poles of an electro-magnet. The currents set up are collected by carbon "brushes" and carried away by these to act in the circuit or be stored in accumulators or storage batteries until required.

The rotation of a cylindrical armature between the

PLATE I.



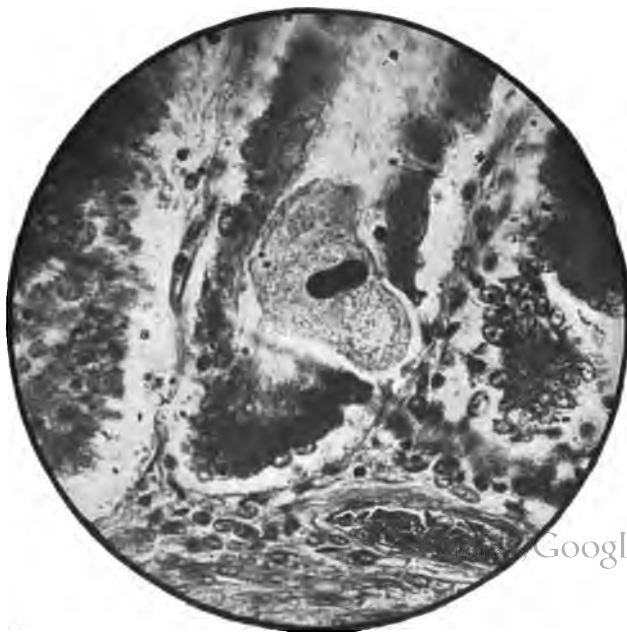
Balantidium coli in lymphatic gland.



Balantidium coli in lymphatic gland, showing beginning nuclear division.

Plates I and II illustrates Bowman's article, page 283.

PLATE II.



Balantidium coli passing through basement membrane of a gland of Lieberkuhn. This might be mistaken for a budding form.



Balantidia in a blood-vessel.

poles of an electro-magnet causes a constant variation in the intensity of the magnetic field—an absolutely essential condition in the production of electrical potential in the conductor. The armature consists of a ring of soft iron built up from a number of soft iron discs insulated from each other in order to prevent the formation of what are called eddy currents, which would cause over-heating. Around the iron ring is wound a coil of wire, the rotation of which through the lines of force generates induction currents in the coil. These currents are *alternating*, the change in sign of the voltage from + to — in any particular portion of the coil taking place as that portion passes the middle line between the north and south poles of the magnet—on the line of commutation, as it is called.

By sinusoidal we mean that the intensity of the current at any moment is proportional to the *sine* of the angle between the plane of the coil and the line of commutation.

Between the poles of the concave electro-magnet the lines of force are straight, and cut the surface of the rotating armature at a constantly varying angle—a right angle when it is opposite the center of the pole of the electro-magnet, and then the angle becomes progressively more acute as the armature revolves until it is moving parallel with them, when no E.M.F. is generated. (See Fig. 18.)

We will follow a phase starting from this point. With the rotation of the armature the conductor enters the lines of force of the opposite pole, and E.M.F. is induced. As it continues to cut them at a constantly varying angle, the E.M.F. increases to a maximum point, at which the conductor is opposite the center of the pole-piece, say S. When the conductor has completed half a revolution, and lies between the poles midway, the current has sunk to zero.

The armature now continuing its course enters the lines of force of the north pole, and fresh E.M.F. of the opposite sign is induced in it. Taking the complete cycle, we find that at 90° the E.M.F. is at its maximum,

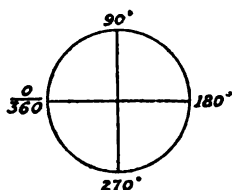


Fig. 19.

at 180° it is at zero, but it at once reverses its direction and increases in the opposite sign, to reach zero again at 360° . This process is repeated to infinity.

Any point P on the circle represents a conductor in the surface of the armature, the circle representing its path of rotation in the magnetic field.

The horizontal line through the circle represents the plane of the coil and zero. The E.M.F. generated in P at any phase of its revolution may be denoted by a perpendicular from this point.

The zero line to the right is divided into sections A, B, C, D, E, and F, representing successive periods of time by marking a series of heights corresponding to the height at the commencement of any of them, and joining. The curve formed will represent the ebb and flow of the E.M.F., and is a true sine curve. The current is obviously an alternating one.

If there be four conductors at 90° apart the current is a biphasic one. If there be three conductors at 120° apart on the surface of the armature a three-phase current will be induced, for there are three sets of conductors moving in a magnetic field and each reaches its maximum at 120° . Each of the conductors will serve in rotation for the reverse current of the other two, so that at any moment $A-B=0$. Such triphase currents are especially adapted to therapeutics, as they produce a rotary magnetic field, and the tissues they act in are in what is known as an "electric whirlpool." The electrodes are placed in intimate contact with the patient's skin and the currents are formed in the body.

The motor should never be suddenly stopped with the electrodes in contact with the patient, or he will receive a severe shock. This is due to back electromotive force developed in the armature. To prevent it the secondary coils should be worked back to the starting points, the ohmic rheostat worked back to weak,

and the current switched off completely. The electrodes may then be safely removed.

Electrodes. For the majority of cases we use a tri-phase current, and three electrodes are then necessary. One large metal plate covered with flannel or wash leather is placed beneath the patient at the level of the lumbar region. A smaller plate is laid on the abdomen just below the umbilicus. For the rectal elec-

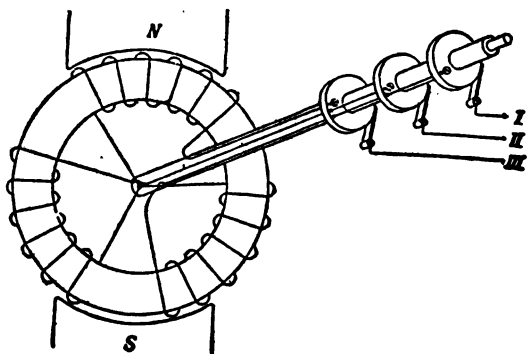


Fig. 20.—Diagram showing arrangement for producing triphase currents.

trode Luke generally uses an uncovered metal one, well vaselined, and finds no difficulty with sinusoidal treatment as regards any undesirable action on the mucous membrane. In this, as in all electrical applications, the electrodes should be of large size.

INTESTINAL PARASITES.

Balantidium Coli. F. B. Bowman⁸ gives the results of his study of *Balantidium coli* for the past three years. His work has been done mostly on 10 cases, 3 of which came to autopsy. The organism is described as follows: It has an oval body from 0.07 to 0.1 mm. in length by 0.05 to 0.07 in width, is pointed anteriorly when the periostome is extended and covered with parallel rows of cilia giving it a striated appearance. It

(8) Jour. Amer. Med. Assoc., Dec. 2, 1911,

has a bean-shaped macronucleus and a globular micronucleus. It apparently has three methods of reproduction: budding, conjugation and division, though in his studies, Bowman has been able to see definitely only the latter, and this is probably the most common. The organism may change its shape in passing through some obstruction, narrowing until the projected portion appears almost like a pseudopod. Sections cut through tissue very often show these processes and they might be mistaken for budding forms.

In the fresh feces, organisms are found in pairs and even larger groups and this has probably often been construed as conjugation, but this grouping seems to be a characteristic of all ciliata and flagellata and is probably in most instances purely physical in character. Both in stained feces and in stained sections of intestinal ulcers these groups were seen, but no cytoplasmic changes were found in the nuclei.

The hog has been thought to be the most common host of the organism, but the method of transmission to the human host is indefinite.

Clinical Symptoms. These somewhat resemble those seen in amebic infections. First of all there is a mild intermittent diarrhea, each succeeding attack becoming more severe than the preceding one, and the simple diarrheic stool gradually becomes dysenteric in character. The patient complains of loss of appetite, indigestion, flatulence and pain in the lower abdomen. He may have palpitation. As the diarrhea becomes more severe there is some tenesmus and bloody flakes and mucus are noticed in the feces. These symptoms may suddenly disappear without any treatment, only to return in perhaps a week or even a month, suddenly and with more severity. These attacks become more numerous and the patient becomes weak and emaciated. The stool finally consists of only necrotic material, clots of blood and mucus, and the patient may die of exhaustion or as the result of perforation.

Prognosis is not good even in the very early stages of the disease. As the infection progresses it becomes rapidly worse, and in the later stages, when the stool

is distinctly dysenteric in character, the prognosis may be pronounced in most cases hopeless.

There is nothing to distinguish the late ulcerations caused by amebas from those caused by the *Balantidium coli*, though the early amebic ulcers appear to be sometimes more punctate in character. The mesenteric lymph-glands may be enlarged and necrotic. The parasites are found in all the layers: mucous, sub-mucous and muscular. Where many of them are gathered together in the subglandular tissues, a surrounding zone consisting of plasma-cells and lymphocytes is found, with an abnormal number of eosinophiles, but with very few polymorphonuclear leukocytes present.

The organisms may enter the mesenteric lymph-glands and cause necrosis. In one of the author's cases, they were found very numerous in one of the sectioned glands and there was some increase in the polymorphonuclear elements present, but no bacteria could be demonstrated and there was no evidence of tuberculosis.

Attempts to infect the monkey with this organism proved unavailing. Whether a break or abrasion in the mucosa of the intestine is necessary for the entrance of the *Balantidium coli*, whether it can force its way through the lining membrane by purely mechanical means or whether a cytolytic ferment is liberated, we do not know. Once it has entered, its progress is limited only by the length of the colon.

The *Balantidium coli* is a parasite which, though not so wide-spread as the ameba, in individual cases is equally serious in its effects. It does not live in the intestine in a state of harmless commensalism, but causes a dysentery which in its late stages is not amenable to medication and usually results in death.

See plate I and II.

Bilharziosis. W. Baetz⁹ reports the occurrence of a case of dysentery due to bilharzia, occurring in Panama. The following account of the characteristics of the ova and development of the worm is given: The ova in the feces of the case reported (see Fig. 21) were invariably lateral-spined and of a rather dark brown color. At no time could they be demonstrated in the

urine. A peculiarity noticed was that the spine of the ovum was not situated in any fixed position relative to the embryo contained within. In the majority the spine was situated at the cephalic end of the embryo, while in a few the spine was found at the other end. The embryo, or miracidium (see Fig. 22), generally bursts its restraining shell within twenty-four hours after having been discharged in the feces. This pro-

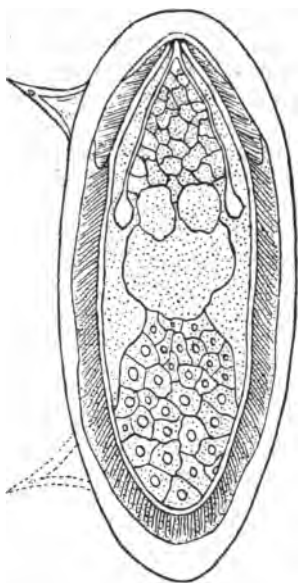


Fig. 21.—Ovum of *Schistosomum mansoni*. The dotted line shows the occasional situation of the spine in relation to the embryo.

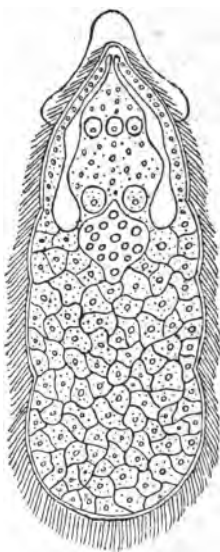


Fig. 22.—Miracidium as it is seen swimming about rapidly by means of its cilia, immediately after having escaped from the shell.

cedure can be hastened by diluting the stools with water. Highly refractile, dancing granules, in a hyaline mass surrounding the cilia, are the first signs of life. Soon after this, the cilia begin to whirl, followed by spasmodic, bilateral contractures of different parts of the miracidium's body. By means of these contractures it finally bursts the shell longitudinally, escapes,

and swims off rapidly. The hyaline mass, containing the dancing refractile granules, remains behind with the shell. The liberated miracidium owes its locomotion almost entirely to its cilia. Only when an obstacle is encountered in its path are contractures and distortions of the body resorted to as a means of overcoming it. So far, any attempt to trace the further development of this parasite, and the mode in which it subsequently infects the human organism, has been unsuccessful.

Oxyuris Vermicularis. P. A. Sheaff¹ reports the following personal observations on a specimen of *Oxyuris vermicularis* obtained by him from a male patient after an enema of an infusion of quassia chips,



Fig. 23.—*Oxyuris vermicularis* with ova just deposited.

and examined while in the fresh state: This canal extended from the cephalic end of the worm to the caudal portion and back again, with numerous turns on itself on the way. One portion of this canal was engaged in shoving an egg, and another portion a great bunch of them, forward, only to be repelled by greater waves of peristalsis sending them back again, until overcome by still greater contractions which forced the ovular mass onward to the terminal portion of the canal. This opened at right angles to the body of the worm, back to the cephalic portion on the right side.

The contents, on reaching this point, seemed to rest awhile, as it were, in the "quiet before the storm,"

(1) Jour. Amer. Med. Assoc., Mar. 30, 1912.

when presently a series of most violent contractions would occur accompanied by the discharge of the eggs, one at a time, from the body of the worm. At times one or two made their exit in orderly succession, and on other occasions the violence and rapidity of their departure reminded one of the action, in miniature, of a modern magazine rifle.

After transferring the parasite from one slide to another and thus securing a half dozen specimens of the ova in "pure culture," Sheaff transferred it to a slide, allowing the water to evaporate, and then mounted the specimen in Canada balsam.

The uterine contractions still continued, less forcibly however, and not until the entire mass of ova within the worm had been expelled into the balsam did such muscular action cease. The specimen is shown at this stage in the sketch (See Fig. 23).

The entire time for the discharge of all the eggs occupied more than two hours. The eggs are elliptical in outline, one side of the ellipse being of greater convexity than the other, with a capsule light greenish yellow in color, and measuring over all 28 by 51 microns. The worm is 6 mm. long and presents a crenated appearance in its anterior third.

Uncinariasis. *Prevalence and Prophylaxis.* W. A. Plecker² emphasizes the prevalence of hookworm disease and the frequent failure of physicians to detect it; it being frequently mistaken for other conditions. He sums up his views as follows:

1. Uncinariasis is the most widespread of the serious diseases afflicting the Southern people.

2. It causes more disability and consequent financial loss than any other infectious disease; perhaps more than the trio: typhoid, tuberculosis and small-pox combined.

3. Uncinariasis in childhood is the great cause for the poor physical condition and lack of school training of many rural dwellers, both youth and adult.

4. That a large proportion of the city and country doctors are not yet aroused to the importance of always suspecting hookworm infection, and looking for it,

(2) Virginia Medical Semimonthly, Mar. 22, 1911. Google

by microscopic examination of the feces for uncinaria ova, is evidenced by the great number of errors in mistaking this for other diseases.

5. Numerous instances have been discovered, when uncinariasis was mistaken for, or was a factor in causing tuberculosis, typhoid fever, malaria, chronic dyspepsia, appendicitis, epilepsy, heart and Bright's disease, puerperal eclampsia, chronic rheumatism, gallstones, eyestrain, neurasthenia, "dropsy," malnutrition of a nursing infant through its mother, and has even been diagnosed as pregnancy in a virgin.

6. Education of teachers, legislators, and the public in the one sure method of prevention, by avoiding soil pollution through the construction and use of sanitary, fly-proof privies, is the work of the medical profession, and constitutes the widest field for usefulness now open to all.

7. Prevention of soil pollution will prevent ground-itch, which is the beginning of hookworm disease, and will at the time be effective against the spread of typhoid fever.

8. Securing this first great step in decent living will make all other sanitary advances easy.

Treatment. W. H. Schultze³ compares the efficiency of the various remedies for the treatment of hookworm disease and concludes as follows:

1. Any practical vermifuge to be effective in expelling uncinaria or ankylostoma must be an irritant of sufficient intensity to cause the parasite to loosen its hold.

2. It should paralyze the neuromuscular apparatus to hinder the parasite from making fresh attachment.

3. Its relative toxicity to the parasite must be either much greater than that for the host or be much more readily absorbed by the former than by the latter.

As has already been pointed out, each of the above remedies is absorbed more or less from the alimentary tract, and Tenholt has even gone so far as to assume that only such drugs as are absorbed can be active in expelling ankylostoma. Since their method of taking food is by way of the mouth they must of necessity be

(3) Jour. Amer. Med. Assoc., Sept. 30, 1911.

poisoned by ingesting the tissues of the host already impregnated with the toxic substance, and if the host does not absorb sufficient thymol, beta-naphthol, male fern, etc., they remain fixed to the intestinal mucosa and are not expelled by the purgative.

Schultze's present experimental data suggest that this is at best only a part of the truth. It happens that drugs like thymol when combined with iodine or the benzole radicle are much less active vermicides than thymol itself. It is also true that thymol iodid, being much less soluble than thymol, is absorbed to a less extent by the intestinal mucosa. *A priori* this would seem to support the idea of Tenholt that thymol iodid has no action on hookworms because none of the drug is absorbed by the host. But if the worms themselves be studied in contact with solutions each of thymol and thymol iodid it is possible to explain the reaction of the worms towards the two drugs on the basis of amount of drug in actual contact with the parasite and the effect of introducing the iodine atom into the molecule, and thus lowering its toxicity. While, therefore, the drug absorbed by the host and ingested by the parasite as a part of the cell and plasma may have a toxic action on the worms, it seems that such drugs as thymol, male fern, chloroform and beta-naphthol, act by direct contact with the worms, causing rapid vermiform movements, and if the irritation is sufficiently great the worms finally attempt to escape. From now on until paralysis sets in not a little of the surrounding media is ingested, since the mouth parts of the parasite are kept in constant action. At this stage the intestinal contents of the host ought to be expelled so as to get rid of the surplus drug and the poisoned or anesthetized worms. Judging from the action on the worms *in vitro*, two to three hours seem to be about the time when the cathartic should begin its work, although in the case of chloroform and eucalyptus the cathartic in the form of castor oil works hand in hand with the chloroform.

In conclusion it may be said that at present thymol is one of the most toxic vermicides for ankylostoma thus far proposed. It is easy to obtain, keeps well, is cheap and is easily administered; it kills the parasites

instead of merely paralyzing them. When taken under the care of a physician who is careful to gauge the dose in accordance with the physical condition of the host, it seems to be the best all-around remedy thus far studied. While dangerous in large doses, it differs from beta-naphthol, male fern, and chloroform, in that the danger is at once apparent and can be controlled by heart stimulants and by methods that help maintain a good blood-pressure until the drug has killed the parasite and the cathartic has removed the excess of thymol, whereas, with the other remedies just mentioned the danger signals are less obvious and usually it is only after irreparable damage is done that one is aware that his patient is in danger of any after-effects.

Beta-naphthol is probably the next pure chemical substance that ought to be tried more extensively on human hookworm subjects. Persons affected with kidney lesions ought not to take it, and when used the urine should be examined to determine whether it causes albuminuria. If the maximum dosage of 2 to 4 gm., divided in two parts and given an hour apart, does not cause renal disturbances in adults, beta-naphthol has much to recommend it as a hookworm remedy.

Male fern at present has not much promise in this country because of the lack of care in collecting the rhizome and in preparing an active ethereal extract. This, however, is a condition which doubtless would soon be remedied if once considerable demand existed for an active extract.

DISEASES OF THE LIVER.

Destruction of Hemoglobin in the Liver. L. Hess and P. Saxl⁴ report the results of their investigations with reference to the destruction of hemoglobin by the liver substance. Their earlier researches showed that certain poisons injected during life hindered the destruction of hemoglobin by the liver tissues remaining alive after somatic death. They were able to observe the same behavior, although not constant, on the livers of human bodies in which toxic infectious lesions had

(4) Deutsche Archiv f. klin. Med., 1911. Digitized by Google .

been produced by various pathologic processes. From the fact that hemoglobin is the material from which the liver produces the biliary coloring matter it results that there must be a certain relation between the content of the blood in hemoglobin or in red blood-cells and the production of bile in the liver. From this point of view the authors thought it would be of interest to determine the relation of the blood with reference to its content of hemoglobin and hemoglobin-bearing cells in cases of disease in which an anatomic or functional change in the liver was probable. An increase in number of the red blood-cells in organic diseases of the liver has been frequently recorded in the literature. According to von Jaksch an excessive number of erythrocytes is frequently observed in phosphorus poisoning in man. The authors experimented by poisoning animals with the poison mentioned and determining the effect on the number of red blood-cells. They found that coincident with the diminution of the power of the liver to destroy hemoglobin there was an increase in the number of red blood-cells in the blood. The possible importance of this observation with reference to the explanation of conditions in which a number of red blood-cells is abnormally increased will be apparent.

Urobilinemia. O. Roth and E. Herzfeld⁵ conclude from investigations of the presence of urobilin or urobilinogen in the blood as follows:

1. It is almost never possible to recognize even with the highest degree of urobilinuria, the presence of urobilin or urobilinogen in the blood-serum.

2. Urobilin when added to the entire blood is no longer recognizable with the fluorescence tests after a few minutes. Most probably this disappearance is caused by an oxidization occurring in the blood.

3. Every serum contains bodies which give the typical reaction for biliary coloring matter.

Opsiuria. In 1901 A. Gilbert and P. Lereboullet described a phenomenon which they named opsiuria and defined as a retardation in the excretion of urine water. While normally the water ingested is excreted soon after the meal, in cases characterized by this

(5) Deutsche med. Wochenschr., Nov. 16, 1911.

symptom it does not appear until long after. Other researches followed and now the authors⁶ have made a thorough study the results of which they present.

In determining the fact two methods of procedure are adopted: 1. The measurement hour by hour of the amount of urine passed, the water being taken with meals or in the interval. 2. The amount of water excreted is compared with that ingested in a fasting condition.

1. Examination of regular urinary fractions during the 24 hours. The patient is required to take only two meals a day, at noon and at 8 p. m., and to omit the first breakfast on the following morning while he takes meanwhile no nourishment. The urine is collected once in every four hours at 4, 8, 12, 4, 8, 12, the amount being measured and recorded. Normally the amount collected shows with considerable variation that the amount taken after meals is large and that in the intervals it is small. In some cases the amount passed during the night is small. In some cases the amount passed during the night is very abundant, and this condition is designated nycturia. In some cases this is due to the recumbent position. This increase must be different from true opsiuria. In other cases the abundance during the night is really due to the distance from the time of meals.

2. In a second method the examination is begun at six o'clock by rejecting the first sample and collecting hourly from that time until midnight. It is important to note whether the patient is sitting up or lying down. The results are somewhat variable and it is common to require two series, one taken with the patient fasting and lying down, and the other with the patient sitting up.

In the normal man station exercises little effect on the disposal of 500 gm. of water; it is mostly eliminated within six hours, and the greater part passes in the first two or three hours. It is quite different in certain cases of portal hypertension. There is in the fasting condition a marked difference between standing and the recumbent position in the amount of urine voided

(6) *Archiv. d. Mal. de l'App. Digest.*, January, 1912.

hourly. On the massive ingestion of water the difference from the normal is still more pronounced. Not only is the urine excreted more slowly but the total amount may be little more and is in some cases actually less than that excreted in the fasting condition. There is really an oliguria due to the massive ingestion of water. This phenomenon may be noted in all forms of cirrhosis of the liver. It also occurs in cholelithiasis, and in the presence of tumors. It is rarely observed as an isolated symptom. It is likely to be accompanied by polyuria or on the contrary by oliguria. The association with anisuria is more significant, especially when there is present opsiuria; with oliguria or anisuria, there is no reason to believe that there is some common condition of the liver underlying them. Opsiuria is also associated in many cases with other symptoms evidently dependent on hypertension of the portal vein.

Such an inversion of the urinary rhythm has been produced by Villaret in dogs by ligation, partial or complete, of the portal vein.

Practical Deductions. The authors value the sign as an evidence of obstruction of the portal vein. The observations indicate the importance of the recumbent position in the treatment of such conditions.

CHOLECYSTITIS.

Etiology and Symptomatology. A. E. Austin⁷ points out the frequency with which cholecystitis simulates gastric disorders and other abdominal affections. He has been surprised at the frequency of the association of the so-called "*Hangebauch*" with gall-stone disease, or cholecystitis, perhaps it would be better to call it, for, as has been shown, we do not always find the stone at operation. On account of the ease with which a gastropexia and a prolapsed right kidney can be found in these women on account of their lax abdominal walls we are often wont to ascribe their attacks of pain in the upper abdomen to this cause; nothing could be more unjustifiable unless a careful investigation of the

(7) Boston Med. and Surg. Jour., Mar. 28, 1912.

gall-bladder region is made. The descent of the pylorus may cause an obstruction to the flow of bile which may lead to the formation of stones.

Perhaps a wrong interpretation will be placed upon this association of stagnation of bile and stone formation; it is not contended that slowing or even interruption of the flow of bile into the intestine may cause the formation of concrements, for Friederich has clearly shown that this is not true, but it is evident that such a condition offers less hindrance to the invasion of micro-organisms into the gall-bladder, which normally is cleansed several times daily by the free flow of bile into the intestine, from which the noxious bacteria come. Then, too, there is always the possibility that anything which interferes with the lumen of the biliary passages may also interfere with the circulation in walls of the viscus, a condition also producing congestion and a tendency to inflammatory changes in its interior. In fact, our views will soon be reversed, and whereas formerly we supposed that the so-called catarrhal condition of the gall-bladder with its copious secretion of mucus was the result of the presence of gall-stones, we shall soon regard a preliminary cholecystitis by whatever means it may be produced as a *sine qua non* for the formation of concretions.

So closely, in fact, may a purulent gall-bladder simulate a pyonephrosis that Lenhartz reports a case of a woman of 51 years of age who had had attacks of pain in the region of the right kidney for many months, a painless tumor in the right lumbar region, albumin, blood and a few casts in the urine, but no pus, and an intermittent temperature for several days. Incision was made in the lumbar region, when a large amount of bile-stained pus was eliminated, but the kidney was found to be sound and with no stone present. Three days later on changing the dressings four gall-stones were found lying under them. When such vagaries as these are found no physician need feel too much chagrin when the surgeon discovers what he cannot; the aid of surgery is usually summoned as a means of cure, but it should be much oftener called for as a means of diagnosis, particularly of obscure ab-

dominal disease. Thus the physician is liable to fall into two errors; he may accept cholelithiasis as the cause of the difficulties from which the patient suffers, and from the frequency of gall-stones at any age beyond 40 an operation will prove their presence, but after their removal the patient does not fully recover; in other words, the stones were quiescent and there was some other cause for his patient's symptoms, or he may regard these erratic manifestations of gall-stone disease as due to something else, and treatment directed to overcome that mistaken condition will be futile.

Diagnosis. H. Lilienthal⁸ emphasizes the importance of examining cases presenting gastric symptoms for a possible disease of the gall-bladder. He refers to cases in which physicians failed to recognize the prominent character of unmistakable symptoms of gall-stone disease because they had become accustomed to regard the patient as the subject of stomach disease.

Gangrene of the Gall-Bladder. Riese⁹ reports a case of gangrene of the gall-bladder occurring as the result of the perforation of a gastric ulcer, and considers that the case should not be regarded merely as a curiosity but as indicating a way in which the gall-bladder may be infected and inflamed without the previous formation of calculi.

Myocarditis and Gall-Stones. At the recent meeting of the American Gastro-Enterologic Association David Riesman¹ stated that in a number of cases of gall-stone disease he had heard a mitral systolic murmur during and shortly after an attack of colic. He had found these murmurs perplexing when the advisability of operative treatment was to be weighed. In all the cases seen by him, the murmur had not existed prior to the attack of colic. It was not due to endocarditis, for it disappeared soon after the attack. It was not due to anemia; and it was not due to jaundice, because it could be heard in cases that did not have icterus. It probably depended on temporary dilatation of the heart. Riesman believed that the chronic disease of the biliary tract, with its accompanying infection, had

(8) N. Y. Med. Jour., Jan. 27, 1912.

(9) Deutsche med. Wochenschr., Oct. 19, 1911.

(1) Boston Med. and Surg. Jour., June 1, 1911.

caused a myocardial degeneration, somewhat akin to that found in connection with fibroid tumors of the uterus. The degeneration predisposed the heart to dilatation when, during the attack of colic, the blood-pressure rose. The murmur was loud and unmistakable. The heart was enlarged, but not to any great degree. Riesman did not consider the presence of the murmur any contra-indication to surgical intervention. Indeed, if the pathogenesis was as stated, it would constitute a point in favor of operation. Care should, however, be taken in giving the anesthetic.

CHOLANGITIS.

B. Naunyn² sums up the principal points of the first Leyden lecture for which he chose the subject of cholangitis, as follows: By an example he desired to emphasize the tendency of medicine at the present day to localization. Starting from a case of gall-stones he traced their origin to cholangitis and found that the latter disease was due to an infected bile which secondarily produced the inflammation of the biliary passages. Cholangitis in cholelithiasis appeared in two forms, one as a lithogenous, stone-forming catarrh and as a calculous cholangitis. The cause of both is an infection from the colon bacillus ascending from the intestine. In calculous cholangitis the disease was exhibited in its manifold clinical pictures. In typhoid bacteriocholia the most instructive example of a hematogenous infection of the bile was found, and in cholangitis accompanying cirrhosis of the liver one became acquainted with another well elaborated form of the disease.

The lecturer closed with cholangitis of the infectious diseases and idiopathic cholangitis. These led him to infectious icterus. In this way he endeavored to bring together what was to be learned with reference to this affection. He expressed the hope that this very dark field would be illuminated by the thorough investigation of the subject of cholangitis.

He presented a clinical theme without reference to

the subject of treatment. It would, however, be not in accordance with the thought of the great clinician by whom these lectures were founded for him to close in this manner. The therapeutic achievement which the knowledge of cholangitis secures for us is not insignificant. Surgery already boasts of its brilliant results. The author noted the temporary biliary fistula by which the disease is treated, but stated that cholangitis is also accessible to treatment by internal means. Not only in the calculous form but also in that connected with cirrhosis and in the idiopathic form, very satisfactory results have been obtained. The author, however, did not consider the subject further because the treatment of calculous cholangitis has long been known and practiced.

JAUNDICE.

Epidemic Icterus. A. N. Collins³ reports an epidemic of jaundice occurring in Austin, Minnesota, 50 cases of which he examined clinically with the following results: Patients were about equally divided among males and females. The youngest was ten months. The onset was chiefly insidious, and close contact with other cases seemed not to be a prevailing factor. Where contact did exist, the time preceding the onset of the more acute symptoms in the exposed person varied from seven to fourteen days. Vomiting occurred in 74 per cent. of the cases, and was very persistent in a few. Abdominal pain was chiefly epigastric tending toward the region of the bile-passages or toward the umbilicus. The appetite was almost invariably poor. About 20 per cent. craved acid or sour substances. Headache was chiefly frontal. The temperature-curve was not characteristic. Slow pulse was not frequently observed. Jaundice appeared at the end of a period varying in length from twenty-four hours to seven days after the onset of acute symptoms. Objective tenderness followed the lines of subjective pain as a rule. General lassitude was a fairly constant and very notable symptom. Itching and desquamation were probably pres-

ent in a larger number of cases than reported. The total length of illness averaged about ten days. The height of temperature bore no relation to the total lengths of illness. City water was consumed in probably a great many more of the cases than reported. There have been no deaths.

Barker and Staden report six cases from which they conclude that the infectious character is clear; that the negative blood-cultures point to a local infection rather than a bacteriemia; that the gastro-intestinal symptoms make a diagnosis of gastro-enteritis necessary, their opinion being that food, probably meat, is the most likely source of the infectious agent; that the so-called Weil's disease is probably not a separate clinical entity; that either water or food must be the source of infection. They advance the further etiologic theory: (1) ingestion of tainted meat containing living paratyphoid bacilli; (2) the development of gastro-enteritis due to this organism; (3) the appearance of catarrhal jaundice due to extension of gastro-enteritis to the biliary passages.

Hemolytic Icterus. Since the experiments of Chauffard and Widal and their pupils two well-defined types of hemolytic icterus are distinguished: congenital icterus and acquired icterus. These two types have clinical and hematologic characters which separate them distinctly. Chalié, it is true, mentions transitional forms between the acquired and congenital form but none of the 3 cases described by him belong to this class according to Macaigne and Pasteur Vallery-Radot.⁴ They report the following case which they consider intermediary.

The patient was a laboratory porter, 48 years of age. He was attacked with icterus of very variable intensity. Under the influence of fatigue, loss of sleep, or liquor, the icterus could be seen to deepen from one day to another in such a way that it was very exaggerated at certain moments, at other times very slight; and at such times it could be seen that the jaundice manifestly increased the discoloration of the skin and mucosæ.

(4) *Gaz. des Hôp.*, July 18, 1911.

The examination of the globular resistance, investigated according to the process of *hematies déplasmatisées* carried out by Widal, Abrami and Brulé by using a 9-per-cent. solution of sodium chlorid, showed hemolysis beginning at 0.66, intense at 0.52, and total at 0.44. On contact with non-hemolyzing sera the red blood-cells of the patient appeared fragile in four out of five tests.

No hemolysin was found in the patient's blood. On mixing twenty drops of the patient's serum with one drop of red cells of a normal subject, hemolysis did not take place either at laboratory temperature or after remaining on the stove for two hours at a temperature of 37° C.

The authors suggest that the case described by them may have inherited a congenital predisposition to globular fragility, which may have remained latent until manifested under the influence of a cause which was not revealed (perhaps poisoning from coloring used in his work).

The authors believe that there is reason to recognize an intermediary type between the congenital and the acquired,—namely, an acquired icterus, with a congenital predisposition to globular fragility.

CIRRHOSIS.

Prophylaxis and Treatment. C. Baumler⁵ emphasizes the importance of prophylaxis of cirrhosis of the liver. The cirrhosis is the terminal stage of a long intoxication, especially from alcohol, but also possibly from lead or other industrial poisoning. It may also be induced by any of the injurious influences which are liable to damage the liver cells, and the attention of the physician should be directed to the prevention of such damage. The special feature of the syndrome induced is the disturbance from stasis and back-pressure of the blood in the portal vein. The same phenomena are liable to be induced secondarily by other affections involving sympathetically the liver or the trunk of the portal vein, such as peritonitis, especially when arising from tuberculosis. Careful differentiation is of paramount importance for treatment.

(5) Deutsche med. Wochenschr., Feb. 1 and 8, 1912. 

In all stages dietetic treatment and regulation of the bowels are the principal thing. Milk should be the main feature of the diet, sweet, sour or buttermilk, watching over the urine, especially over the excretion of urobilin. Saline laxatives for a time may be needed, a warm solution of Carlsbad salts in the morning or cascara at night. In the early stages it is often an easy matter to restore conditions to normal in this way, especially when the trouble is due to abuse of alcohol. Organs are able to recuperate amazingly, and particularly the liver, if it is not being constantly subjected to new injury. If the liver is enlarged and hard, with more or less tendency to jaundice, the spleen somewhat enlarged and the abdomen distended, the wearing of an abdominal band may be useful to keep the over-heavy organs from sagging or being pushed about, thus interfering still further with the portal circulation. The binder should not be allowed to interfere with the movements of the diaphragm. With ascites, he warns not to wait too long before tapping; release of the fluid restores better conditions for the circulation.

Drugs which act on a weakened but still sound heart or on the kidneys or which render the blood more fluid may sometimes cure the tendency to ascites in cirrhosis of the liver. Even salt, which aggravates dropsy with kidney or heart disease, may draw the water out of the tissues and expel it through the kidneys. He cites Savy's case to illustrate this: A man of 51 with atrophic cirrhosis of the liver had required tapping six times in two months, each time over twelve liters of fluid being withdrawn. He was kept on a milk and salt-free diet, but wearying of this he cast aside all restrictions and ate at will, using salt lavishly, up to 25 or 30 gm. a day. By the end of a few weeks the ascites had disappeared, and has not returned. Bäumlér advocates omentopexy for suitable cases, not waiting too long; operations to divert the bile and remedy conditions with severe cirrhosis should be considered as needed.

HEPATIC SYPHILIS.

Pathology. In discussing visceral syphilis, Frank Billings⁶ places syphilis of the liver as the most common

(6) Jour. Amer. Med. Assoc., Nov. 18, 1911. Digitized by Google

manifestation. The syphilitic process may consist of a diffuse interstitial hepatitis with enlargement of the organ, which may occur congenitally. In this condition the liver is large, smooth and the cut surface is of a gray yellow appearance. It may appear early and usually is fatal. The same type may occur in later life, most commonly in adolescence associated with other evidences of syphilis in the form of interstitial keratitis, rhagades, Hutchinson's teeth and sometimes with small stature amounting to infantilism.

A diffuse interstitial hepatitis of the acquired type may occur, which partakes frequently of hypertrophic cirrhosis. In this type the liver is enlarged, smooth and sometimes tender to the touch. There may be a moderate jaundice, and fever of the intermittent type is not infrequent, associated with chills and sweats. An atrophic cirrhosis with recurring ascites may also occur in acquired syphilis. This may be a later stage of the hypertrophic form. Gummas may appear in the hilum of the organ and by pressure on the portal vessels produce ascites.

The lesion may consist of gummas in the form of tumors measuring from 2 mm. in diameter to the size of a fetal head. They may be single or multiple. These tumor masses may produce enormous enlargement of the organ. There may be jaundice. Usually there is an intermittent or remittent type of temperature with or without chills, and frequently there are night sweats. There may be great tenderness and spontaneous pain. With small gummas the clinical phenomena may last for a variable period and disappear. Recurrences over years of time are not unusual. Lessened strength, endurance and loss of weight and a muddy complexion are of frequent occurrence. Gummas situated near the bloodvessels or gall-bladder may simulate other diseases. He reports four cases.

There can be no question that diffuse interstitial hepatitis of a chronic type is of rather frequent occurrence and when treated in a general way develops into cirrhotic atrophic type. Early antisymphilitic treatment would in many instances cure such patients. The scarred liver, the result of gummas, or the botryoid liver consisting of

deep fissures comprised of dense bands of connective tissue partially or completely separating portions of the liver into small lobules, is usually without symptoms. Such a type of liver usually is sequel of syphilis of the liver either congenital or acquired, or may be a latent manifestation.

A Clinical Case. E. J. Mullally⁷ reports a case of lues of the liver which terminated fatally and presented the following:

Anatomic Diagnosis: Unilobular, megasplenic cirrhosis hepatitis, and multiple gummata; chronic pericholecystitis; chronic pancreatitis; chronic peripancrreatitis; thrombosis of the portal vein; atypical ulceration of the stomach with polyposis; secondary deposits in the pyloric and lumbar glands; extreme ascites; early suppurative peritonitis (general); chronic adhesive pleurisy (right base and left, universal); right pleural effusion; hypostatic pneumonia; bronchitis; hemorrhages of pericardium; dilated right auricle and right ventricle; chronic adhesive perihepatitis; chronic adhesive perisplenitis; giant spleen; subdiaphragmatic abscess (right); subacute hemorrhagic appendicitis; passive congestion of the alimentary tract; chronic tubal nephritis with passive congestion; fibrosis of the testicle.

Mullally comments on the following interesting features: The superficial ulceration of the stomach found at the autopsy was evidently the cause of the first symptoms recorded in the patient's illness. It is debatable whether this condition can be looked upon as of primary origin or whether it is a secondary event in the course of the generalized fibrotic change discovered throughout the stomach. Lesions of this nature are of great interest, not only from the point of view of their causation, but also from their resemblance to sarcoma when they occur unaccompanied by pathologic lesions elsewhere.

The changes in the liver were very marked. There was great deformity, and atrophy of the right lobe which may have been due to a partially thrombosed portal vein, because the superior mesenteric vein which is believed largely to supply the right lobe, was thrombosed. In another case where an abscess in the spleen produced

(7) *Canad. Med. Assoc. Jour.*, February, 1912.

thrombosis of the splenic vein, atrophy of the left lobe of the liver was noted in the autopsy findings.

Apart from these changes the liver presented other pronounced pathologic lesions, (a) a number of round, soft-centered nodules of fibrous, connective tissue, (b) a great increase in the amount of fibrous, connective tissue. Concerning the nodules found, they were undoubtedly gummata. There was no evidence of actinomycosis or tubercle either in structure or by discovery of an organism. Furthermore, the distribution of the nodules and the appearance of the tissue about them were rather characteristic. That they were there for some time was evident from their degenerated centers and from the dense arrangement of the fibrous tissue about them. The distribution of the fibrous tissue was also suggestive, extending as it did in dense, radiating bands, particularly over the diaphragmatic surface and in the neighborhood of the round ligament. It was also present in some quantity about the track of the large portal branches, and spread irregularly into the organ, producing large, scarred areas of liver tissue. The microscopic findings showed extensive changes in all parts of the liver, so that the functions of the gland must have been markedly interfered with.

The spleen in this case was about eight times larger than normal. Splenic enlargement is usually greater in biliary than in portal cirrhosis. Two main theories are usually advanced to account for the great size of the organ in cases of portal cirrhosis, (1) mechanical from backward pressure, and (2) toxemic, *i. e.*, circulating poisons reaching the spleen through the splenic artery. The chief reasons for regarding the changes in the spleen in this case as secondary to the liver are: (1) The flabby appearance of the organ at autopsy with no increase of connective tissue as seen by the naked eye; (2) the much greater degree of fibrotic change (both megascopically and microscopically) in the liver; (3) the fact that the onset of clinical signs as well as the duration of the disease in this case are not in accord with what is usually described in Banti's disease. On the other hand, spleens of this size are the exception, rather than the rule, in cases of hepatic cirrhosis with portal obstruction.

Ascites: The ascites which occurs in portal cirrhosis is usually ascribed to the mechanical effects of the increased fibrous tissue. Rolleston believes that it is due to the effect of poisons, which the hepatic inefficiency is unable to prevent from circulating, "having a lymphagogue action and therefore inducing an exaggerated flow of fluid into the peritoneal cavity." In this case there were a number of factors, each able to bring about marked ascites; the increased fibrous change, especially round the gummata, in the liver, a perihepatitis, partial thrombosis of the portal vein, chronic peritonitis, and towards the end a failing heart; so that it is impossible to tell with any accuracy the part played by any one of these factors in this connection.

The recent peritonitis with small, subdiaphragmatic abscess found at autopsy was most likely due to the tapping and the greatly lowered resistance of the patient. The favorable ascitic culture medium greatly facilitated the growth of any organism accidentally introduced.

Gumma of the Liver. V. L. Schrager⁸ describes the clinical characters of gumma of the liver with the following conclusions:

1. The clinical statistics underestimate the frequency of syphilis of the liver. The Wassermann reaction will increase the number of cases.

2. The symptom-complex of syphilis of the liver is not pathognomonic, as it stimulates almost every hepatic disease; occasionally it stimulates febrile diseases.

3. Whenever the diagnosis is uncertain, resort should be had to the therapeutic test as well as to the Wassermann reaction.

4. Mixed treatment frequently has a striking effect on lues of the liver, regardless of the time it has existed.

HEPATIC NECROSIS.

LeRiche⁹ reports a case in which the entire right lobe of the liver was affected with an acute necrosis, the entire duration of the disease being seventeen days. The diagnosis of abscess of the liver having been made, a laparot-

(8) Jour. Amer. Med. Assoc., Mar. 9, 1912.

(9) Lyon Méd., Jan. 7, 1912.

omy was performed and puncture of the liver in several directions was made. No pus or other liquid could be obtained. The patient died some days after and at the autopsy no pathologic change was found except the enormous liver of which the whole right lobe was transformed into a necrotic cavity without pus and without liquid. While an intestinal origin might be suggested it is possible that the digestive troubles and the diarrhea were signs of the hepatic attack. Cultures made with the blood from the punctures gave no result.

SARCOMA OF THE LIVER.

C. H. Lilley¹ reports a case of melanotic sarcoma of the liver in a woman aged 46, who had had an eye removed ten years previously for melanotic sarcoma. On admission the patient was well nourished and not at all cachectic in appearance. An examination of the abdomen showed the presence of a very large and hard tumor filling the greater part of the abdominal cavity. Its upper limit was represented by a line drawn horizontally across the chest at the level of the fifth rib. Laterally the tumor filled both flanks. It was just possible to get the edge of one's hand between the tumor's lower limit and the pubic arch, and at the middle of the lower border a distinct notch could be felt. The surface of the tumor was nodular in places. The hemopoietic and other systems were normal. The urine did not darken very much on standing, but on the addition of a few drops of ferric chlorid it at once darkened, a black deposit forming.

At the post-mortem examination the liver was found to be enormously enlarged and it weighed 19 lbs. 6 oz. in fresh condition. It was very dark in color. On cutting into the tissue it was found to vary in color, being coal-black at some places and at others of a grayish-black color. The growth was diffuse, and only one or two islands of normal liver tissue were to be seen.

Lilley calls attention to: (1) the long period—viz., 10 years—which had intervened between the removal of the primary growth and the secondary invasion of the liver;

(1) Lancet, Aug. 5, 1911.

and (2) the large size to which these secondary growths in the liver may attain.

CARCINOMA OF THE LIVER.

I. Karsner² presents a careful study of 9 cases of carcinoma of the liver with some review of the literature. All 9 cases were associated with cirrhosis, and the nature of this association forms an extremely interesting question. The author says: "Two essential views are held as to this relationship, the first being that the two are present in the livers simply as the result of coincidence, Frohmann taking this stand. It is true that relatively few cases of cirrhosis of the liver show cancer, yet they show cancer-like changes in the increased number of ducts and the isolated islands of irregularly arranged liver-cells, sometimes to such a degree as to render the final diagnosis very difficult. Rolleston goes so far as to say that mistakes of this sort have been made in many cases. In spite of this, the very marked frequency of their occurrence, and the fact that secondary cancers are not very commonly associated would lead to the rejection of such a view."

The view of Gilbert, Claude and others who assert that the cancer is the primary process and produces the cirrhosis is also rejected. Many claim that cirrhosis precedes the cancer and is etiologically at the basis of the malignant growth. To appreciate this view it is necessary to accept the view that cirrhosis is secondary in itself to some injury to the liver substance, and that the fibrosis occurs as a replacement process. Clinical and experimental observation point this way so strongly that the assumption seems fully warranted.

A third view as to the relation of cirrhosis and cancer is that a productive or organogenic irritant produces proliferation of connective tissue, bile-ducts and liver parenchyma. This view is ably supported by Jäger in his work on deer's livers. There are many considerations which force one to regard this view favorably. The author summarizes his researches as follows:

Carcinoma of the liver occurs more frequently in men

than in women, is seen most frequently in the fourth and fifth decades of life and very often is accompanied by a personal history in which some etiologic factor of cirrhosis of the liver is found. Clinically vague gastro-intestinal symptoms like those of early atrophic cirrhosis are noted and are followed by more marked digestive disturbance, cachexia and frequently jaundice. Ascites, edema of the lower extremities, splenic tumor and more rarely fever present themselves in a variable number of cases. The course of the disease is rapid.

Pathologically the disease shows three gross anatomic forms, nodular, massive, diffuse, and two microscopic forms, carcinoma solidum and carcinoma adenomatosum. In the liver itself cirrhosis is an associated condition in almost all cases, tumor thrombosis of the intrahepatic bloodvessels is common and intrahepatic metastases are frequent. Extrahepatic metastases are more common and more widely spread than is usually believed, and their distribution, together with the frequent presence of tumor thrombosis of the intrahepatic bloodvessels, leads to the conclusion that the transmission of the condition to other organs is largely through the vascular system. Cirrhosis of the liver, or the factors which commonly are believed to produce cirrhosis, play an important part in the etiology of primary carcinoma of the organ, and the tumor may originate from either the essential hepatic cells or from the bile-duct epithelium. Those tumors which arise from the liver-cells are more likely to be of the solid form, and those from the bile-ducts are more likely to be of the glandular form, but this is not an invariable rule.

DISEASES OF THE PANCREAS.

Physiology. After a study of the effect of water-drinking on the activity of the pancreatic function P. B. Hawk³ summarizes his work as follows:

The problem studied was the activity of the pancreatic function under the influence of water-drinking at meal time. Normal men were used as subjects and were required to ingest a diet uniform in all respects from day

to day. Three experiments were made, each experiment being divided into three periods; a *fore* period in which the subject was brought into nitrogen equilibrium through the ingestion of a uniform diet supplemented by a minimal water ingestion; a *water* period during which the water ingestion at meal time was increased from 1,500 to 4,000 c.c. per day; and an *after* period in which the dietary conditions of the fore period prevailed. Two of the experiments were on the influence of *moderate* water-drinking and in these the volume of the extra water ingested during the water period was 1,500 c.c. per day or 500 c.c. per meal. In the third experiment the influence of *copious* water-drinking was studied and in this instance the subject was required to ingest on each day of the water period 4,000 c.c. above that ingested in the fore and after periods.

The amylolytic activity of the feces, denoting, according to Wohlgemuth, the content of pancreatic amylase present in the feces, was taken as the index of the activity of the pancreatic function. The amylolytic values for the stools dropped during the periods of minimal water ingestion. This finding may be interpreted as indicating that the drinking of water with meals had stimulated the pancreas. We make this interpretation with certain reservations regarding conditions not controlled by the Wohlgemuth method. Two stools were encountered in the course of the investigation which exhibited a pronounced acid reaction. Inasmuch as the basic principle of Wohlgemuth's method is the hydrolysis of starch solutions through the medium of unneutralized fecal extracts, the method does not give dependable data as to the amylase content when such stools are under examination.

This is true especially in view of the fact that it has been shown that 0.004 per cent. hydrochloric acid will increase the activity of amylase 400 per cent., whereas 0.009 per cent. hydrochloric acid will cause absolute inhibition. The power of feces extracts, therefore, to hydrolyze starch cannot be taken as a measure of the amylase present unless precautions are taken to neutralize the fecal extracts and then make the conditions uniform for the action of the enzyme if present.

On the basis of the data gathered in this and in associated investigations made in his laboratory and elsewhere, the author is prepared to draw the general conclusion that the ingestion of quantities of water at meal-time ranging in volume from $\frac{1}{2}$ to $1\frac{1}{3}$ liters stimulate the pancreatic function in two ways: first, a direct stimulation of the nervous mechanism of the pancreas brought about while the water is still in the stomach and, second, an indirect stimulation brought about on the entrance of the increased volume of acid chyme into the duodenum. The drinking of water with meals ought therefore to bring about a more rapid and complete digestion and absorption of the fat and carbohydrate constituents of the diet, two observations verified by experimentation in the laboratory.

Functional Diagnosis. J. H. Pratt⁴ discusses the functional diagnosis of pancreatic disease. The importance of the pancreas in the metabolism of sugar is undoubted, although the way in which the pancreas acts is unknown. Amid much that is obscure one fact is clear. The total removal of the gland is always followed by diabetes which runs a rapidly fatal course.

It was formerly held that if the pancreatic juice was entirely excluded from the intestine a serious disturbance took place in the digestion of nitrogenous food, fats and starches. New studies beginning with those of Friedrich Müller threw doubt on the correctness of the accepted views. Müller showed clearly by careful chemical studies that steatorrhea was not pathognomonic of pancreatic disease, for fatty stools occurred in icterus. He claimed, moreover, that in pancreatic disease unassociated with jaundice there was no disturbance in the assimilation of fat and nitrogen.

Within the last few years several researches on the effect of tying the pancreatic ducts have been published in Europe. The results of these animal experiments supported the clinical observations of Müller. Quantitative analyses of the feces seemed to show that little or no disturbance in the utilization of the fat and nitrogen of the food resulted from shutting out the pancreatic juice from the intestine.

(4) Amer. Jour. Med. Sciences, March, 1912.

Observations in the author's laboratory have shown the error of these views. Total exclusion of the pancreatic juice from the intestine always resulted in a great decrease in the assimilation of fats and proteins. As soon as the animal recovered from the operation and began to take food in quantity the stools became very large, soft, and fatty. There were usually several movements a day. On microscopic examination the feces were found to consist largely of undigested muscle fibers. In spite of ravenous appetites the dogs lost weight rapidly. Since the publication of the paper of Pratt, Lamson, and Marks, additional experiments made by Murphy and Pratt have yielded confirmatory results. It is a difficult matter to exclude all the pancreatic juice from the intestine, and failure to do so explains the results obtained by other investigators.

Experiments on dogs showed that the disturbance in absorption is slight when a small amount of functioning pancreas is left in connection with the intestine.

Decreased pancreatic secretion was recognized by the presence of many muscle fibers in the stool, not by any excess of fat.

In the recognition of severe pancreatic disease there is no single symptom of greater significance than bulkiness of the stools. This is a diagnostic sign to which Osler, Musser, and others have called attention. Much information can often be gained from the weight of the dried stools, and this can be ascertained even when facilities are not available for exact chemical analyses. All that is necessary in addition to scales for weighing is a water bath and a ventilating hood. With pancreatic juice absent from the intestine, not only are the stools voluminous, but the dried residue is much in excess of the normal.

Macroscopic Examination of the Feces. The light color of the feces is the most important sign of pancreatic disease brought out by the naked eye examination. This is due to the presence of fat, and if the amount of fat is large the stools become almost white. As the stools in icterus are also fatty, it may be necessary to make use of Schmidt's corrosive sublimate test for bile pigment in order to make sure that the pale color of the stools is

not due in part to absence of hydrobilirubin. It should be borne in mind that fatty stools also occur in other conditions, chief of which are jaundice, already mentioned, diseases of the intestinal wall, and tabes mesenterica.

The fat appears in the form of droplets, needle-crystals, and as structureless plates or flakes. The most trustworthy sign of the lack of pancreatic juice in the intestine is the presence of large numbers of yellow muscle fibers with sharp edges and with striations well preserved. They may be so numerous as to cover the entire field of the microscope when a low power is used.

Absorption of Fat and Nitrogen. When the pancreatic duct is completely occluded by experiment the absorption of fat and nitrogen is greatly retarded. In a metabolism experiment on a patient with cancer of the pancreas and obstructive jaundice, Spooner and the author found that 79.9 per cent. of the fat of the food was excreted in the feces and 34.8 per cent. of the nitrogen.

Effect of Administering Pancreas. The feeding of raw pancreas and pancreatic preparations causes an increased absorption of fat and nitrogen when there is a lack of pancreatic juice in the intestine. In dogs with pancreatic juice absent from the intestine the feeding of fresh pancreas was followed by a great decrease in the loss of fat and nitrogen. The results of absorption experiments made by a number of investigators have been collected by Tileston. They show that pancreas and pancreatic preparations often decrease greatly the loss of nitrogen and fat in the feces. Sometimes, however, the effect of pancreatic preparations is so slight that it cannot be recognized unless an absorption experiment is performed.

Demonstration of Trypsin in the Stools. The Serum Plate Method. Müller and Schlect found that trypsin would act upon the surface of a serum agar plate, producing small depressions. They demonstrated by this method the regular occurrence of trypsin in normal feces. The plates were kept at a temperature of 50° or 60° C., so that bacterial action was prevented. In several cases of primary and secondary disease of the pancreas trypsin was absent from the feces or greatly dimin-

inished. A number of investigators have found this method of value. It yielded positive results in 5 out of 6 cases of pancreatic disease examined by M. Hirschberg.

The Casein Method. Casein in alkaline solution is precipitated by acidifying with dilute acetic acid. When the casein is digested by trypsin the addition of acetic acid produces no clouding of the solution. This is the basis of a method introduced by Gross for detecting the presence of trypsin. More than 200 stools were examined by him, and in all cases in which disease of the pancreas could be excluded a protein-splitting ferment was present in the feces.

That an absence of trypsin in the feces always indicates disease of the pancreas is doubtful. No trypsin could be demonstrated in the feces of one of the workers in the author's laboratory. Four tests were made during a period of ten weeks. He presented no symptoms of disease.

Demonstration of Trypsin in the Stomach Contents. Boldyreff, in Pawlow's Institute, made the important discovery that the feeding of a large amount of olive oil to dogs caused the regurgitation of pancreatic juice and bile from the duodenum into the stomach. Volhard and his pupil Faubel were the first to use this method in the clinic. A breakfast, consisting of 200 c.c. of pure olive oil is given, or in place of the oil 250 c.c. of cream may be used. As trypsin cannot be demonstrated in a strongly acid gastric juice, half a teaspoonful of magnesia should be given before breakfast and twenty minutes later, as suggested by Lewinski. Some remove the stomach contents in half an hour, others at the end of forty-five minutes. Trypsin estimations can be made by Volhard's method or more easily by that of Gross. The demonstration of trypsin proves the efficiency of the pancreas; failure does not necessarily show that the pancreas is inefficient.

Demonstration of Trypsin by Duodenal Intubation. Attention should be called to the ingenious method of obtaining pancreatic juice directly from the duodenum devised by Einhorn. A gold acorn-shaped bucket, the size of a bean, is swallowed. Attached to the bucket is a strong silk thread, the free end of which, passing

out of the patient's mouth is fastened around his neck or to his clothes. After time has elapsed for the bucket to enter the duodenum a catheter is passed along the thread and so guided into the duodenum. By means of a syringe it is then possible to aspirate the duodenal contents through the catheter.

Diastase in the Feces. Within the last two years a new laboratory test has been employed by a few investigators in the diagnosis of pancreatic disease which is full of promise. This is the quantitative determination of the diastatic ferment in the feces and urine. Strasburger was the first to show that diastase was normally present in the stools of adults. Its occurrence in the feces of children had long been known. Strasburger thought the starch-splitting enzyme was a product of intestinal secretion. Its clinical significance was not realized until Wohlgemuth proved that the diastase of the feces came chiefly from the pancreas. The original method of diastasimetry is that of Roberts.

Diastase in the Urine. The observation of Wohlgemuth that the experimental occlusion of the main pancreatic duct in dogs is followed by a marked rise in the amount of diastase in the urine led to the important discovery that in acute functional disturbances of the pancreas in man a similar increase in the diastase of the urine occurs. In 2 cases Wohlgemuth obtained values of 625 and 1250, while the highest observed normally was 150 units. Hirschberg found a large amount in 2 cases of acute pancreatitis, and Wynhausen in 2 cases of cancer of the pancreas. The increase is seen only in acute disease or at the onset of increased disturbance of function which may occur in a chronic disease.

Lipase in the Urine. Opie, in 1902, reported the occurrence of a fat-splitting ferment in the urine of a case of acute hemorrhagic pancreatitis. His test is open to criticism, because the possibility cannot be denied that the lipolytic action he observed was due to bacteria. Hewlett has clearly demonstrated, however, that lipase appears in the urine of dogs after obstruction of the pancreatic duct, and during acute pancreatitis experimentally produced. In 2 cases of acute pancreatitis Pratt could find no fat-splitting ferment.

Ethereal Sulphates in the Urine. Absence of pancreatic juice diminishes intestinal putrefaction because bacteria break down proteins less easily than they do the end-products of pancreatic digestion. Hence the claim has been made that in pancreatic disease the ethereal sulphates in the urine are decreased or absent. In the urine of a normal dog on a meat diet, Pratt found the ratio of ethereal to preformed sulphates was 1 to 9. In a dog with pancreatic juice absent from the intestine the ratio was 1 to 21.6 on one day, and 1 to 23.5 on the following day. Rosenberg, after tying one or more of the pancreatic ducts in a dog, found the ratio was 1 to 15.9. Gigon, in the urine of a patient with pancreatic calculi, obtained a ratio of 1 to 39.3, while normally it is about 1 to 10. Le Nobel, in a case of pancreatic disease, found "no conjugate sulphuric acid." There was no decrease in the ethereal sulphates in a case of pancreatic insufficiency studied by Tileston.

Alimentary Glycosuria. If a lowered limit of assimilation for sugar exists in patients with suspected pancreatic disease, it can be discovered by giving 100 grams of glucose and testing the urine for sugar during the following twenty-four hours. The solution of glucose may be made more palatable by the addition of coffee. It is better to give the sugar after a light breakfast rather than on a fasting stomach. In a collection which Pratt made of 37 cases of pancreatic disease, carefully studied by functional methods, spontaneous glycosuria occurred 6 times and alimentary glycosuria 4 times. Only 2 of the 10 cases were cancer.

Diagnosis of Acute Disease of the Pancreas. Until recently the functional tests have furnished little, if any, aid in the recognition of acute pancreatitis. Pratt knows of no case in which a serious interference with the absorption of fat and nitrogen has been shown. Stockton has recently called attention to the slight disturbance of the fat digestion. Pfatt made an analysis in one case and found only 17.4 per cent. of fat in the dried stool; 50.3 per cent. was in the form of neutral fat, 21.6 per cent. as fatty acid, and 28.7 per cent. as soap. There was 5.8 per cent of nitrogen.

Recent observations on the occurrence of large

amounts of diastase in the urine in acute pancreatitis give foundation for the hope that a determination of the diastase in the urine may prove of great aid in the diagnosis.

Diagnosis of Chronic Disease of the Pancreas. Pancreatic insufficiency, even of mild degree, can be recognized by the functional methods of diagnosis now available. At the present time no single sign or symptom can be accepted as pathognomonic of pancreatic disease, but by the use of a number of different tests the diagnosis can be made. The functional tests have thrown much light on the pathologic physiology of the pancreas. Observations made with these tests indicate that diminished or altered secretion of the pancreas may occur without demonstrable anatomic changes in the organ.

Among the cases reported by surgeons of the type of chronic pancreatitis described by Mayo Robson, none were found in which the evidence was convincing that pancreatic insufficiency was present, or that the obstructive jaundice was due to pressure exerted by a swollen pancreas. In many cases the symptoms might equally well be attributed to chronic cholangitis. As Riedel pointed out, the icterus associated with stone in the common duct is much more often due to inflammation of the duct than to mechanical obstruction produced by the stone.

It should be borne in mind that a hard pancreas is not necessarily a diseased pancreas. In some cases the diagnosis of chronic pancreatitis was based on the hard feel of the pancreas at operation, and subsequently at autopsy a normal pancreas was found. It is a matter of common knowledge among pathologists that a normal pancreas may have a consistence of almost stony hardness. These facts are brought forward to emphasize the importance of co-operation between the surgeon, the clinical pathologist, and the pathologic anatomist. If the cases which the surgeon at the operating table regards as chronic pancreatitis are examined with the aid of the functional methods of diagnosis, pancreatic insufficiency, if it exists will be detected. Proof will then take the place of conjecture, and knowledge of pancreatic disease will advance.

Pancreatic Function. A Modification of Wohlgemuth's Method of Estimating the Amount of Amylase.

P. B. Hawk⁵ presents a modification of the method of Wohlgemuth for estimating the amount of amylase. He found that amylase is very susceptible to the influence of acids and that the excessive acidity that certain specimens of the feces presented tended to increase the amount of activity of the amylase, whereas alkalies exerted an inhibitory action. Tests with organic acids like lactic acid and acetic acid showed that traces of organic acid facilitated the action of the enzymes, whereas acid concentration but slightly in excess of these, caused complete inhibition. It is evident, therefore, that only neutralized extract should be examined if the application of Wohlgemuth's method is to be of any real service to the clinician, and in order to eliminate the question of uncertainty in connection with the interpretation of the data obtained from stools possessing a concentration of H or OH ions far above normal limits. This difficulty was obviated by the use of a phosphate mixture containing 0.1 mol. dihydrogen sodium phosphate and 0.2 mol. disodium hydrogen phosphate per liter. This was prepared in a 1-per-cent. solution of sodium chlorid.

The following is the technic employed by Hawk: Weigh accurately about 2 gm. of fresh feces into a mortar, add 8 c.c. of phosphate-chlorid solution (0.1 mol. dihydrogen sodium phosphate and 0.2 mol. disodium hydrogen phosphate per liter of 1-per cent. sodium chlorid), 2 c.c. at a time, rubbing the feces mixture to a homogeneous consistency after each addition of the extraction medium. Permit the mixture to stand at room temperature for a half-hour with frequent stirring. We now have a neutral fecal suspension. Transfer this suspension to a 15 c.c. graduated centrifuge-tube, being sure to wash the mortar and pestle carefully with the phosphate-chlorid solution, and add all washings to the suspension in the centrifuge-tube. The suspension is now made up to the 15 c.c. mark with the phosphate-chlorid solution and centrifugated for a fifteen-minute period, or longer if necessary, to secure satisfactory sedimentation. At this point read and record the height of the sediment

column. Remove the supernatant liquid by means a bent pipette, transfer it to a 50 c.c. volumetric flask and dilute it to the 50 c.c. mark with the phosphate-chlorid solution. Mix the fecal extract thoroughly by shaking and determine its amylolytic activity. For this purpose a series of six graduated tubes is prepared, containing volumes of the extract ranging from 2.5 c.c. to 0.078 c.c. Each of the intermediate tubes in this series will thus contain one-half as much fluid as the preceding tube. Now make the contents of each tube 2.5 c.c. by means of the phosphate-chlorid solution in order to secure a uniform electrolyte concentration. Introduce 5 c.c. of a 1-per cent. soluble starch solution and three drops of toluol into each tube, thoroughly mix the contents by shaking, close the tubes by means of stoppers, and place them in an incubator at 38° C. for twenty-four hours. At the end of this time remove the tubes, fill each to within half an inch of the top with ice-water, add one drop of a decinormal iodine solution, thoroughly mix the contents and examine the tubes carefully with the aid of a strong light. Select the last tube in the series which shows entire absence of blue color, thus indicating that the starch has been completely transformed into dextrin and sugar, and calculate the amylolytic activity on the basis of this dilution. In case of indecision between two tubes, add an extra drop of the iodine solution and observe them again.

Diagnosis of Pancreatic Disease. The Fuld-Gross-Goldschmidt Method. L. G. Heyn⁶ describes the method which he has used in the diagnosis of pancreatic disease: The Fuld-Gross-Goldschmidt method requires a solution containing 1 gm. each to the liter of casein, chloroform and sodium carbonate. To 5 c.c. of this solution varying dilutions of stool filtrate are added in different test-tubes, or, in the absence of a fluid stool, 5 gm. of stool is rubbed up with 20 c.c. physiologic salt solution, centrifuged and filtered and added to the casein solution. The mixture is allowed to digest at 38° to 40° C. for twenty-four hours, and the end-result is tested by the addition of a 1-per cent. acetic acid solution which causes a precipitate in the tubes, when digestion is in-

(6) Jour. Amer. Med. Assoc., Aug. 12, 1911. by Google

complete. The Fuld-Gross method proved very satisfactory in Heyn's work in the hospital and was carried out at the same time as the Wohlgemuth method for amylopsin. The method of Wohlgemuth requires a 1-per-cent. solution (Kahlbaum's soluble starch), which is best prepared on a water-bath for eight to ten minutes with considerable stirring. Similar dilutions of stool filtrate as in the Fuld-Gross method are added to 5 c.c. of the starch solution in test-tubes, toluol added and the whole digested for twenty-four hours at from 38° to 40° C. At the end of this time the test-tubes are filled to near the top with tap-water, one drop of a decinormal iodine solution is added to each tube, and a blue color no longer appears in the tube when the starch has been entirely digested. The dilutions of stool used for both the trypsin and amylopsin tests are the same and are made with physiologic salt solution. In dilutions of 1 to 10, 1 to 100, 1 to 1,000 they are sufficient for all purposes. Of each of these dilutions it is best to take 2 c.c., 1 c.c. and 0.5 c.c., which are added to the tubes containing either casein or starch. The quantitative estimation of the ferment content is reckoned from the tube containing the greatest dilution, which has still been able to transform the starch or casein. The estimation is made in units, one unit representing the ability of 1 c.c. stool filtrate to transform 1 c.c. starch or casein solution. Suppose that the tube containing 1 c.c. of the 1 to 1,000 dilution is the greatest dilution which can transform 5 c.c. of starch solution; then 1 c.c. of undiluted filtrate would thus be able to digest 5,000 c.c. of starch solution, which would represent 5,000 units, a normal finding. The number of units usually ranges between 500 and 5,000, though cases may show 10,000 units and even higher, and 100 units may be considered the minimum. In Heyn's tests the non-pancreatic cases did not fall below 250 units, while the greatest interest attached to those giving a smaller number of units, which pointed to a deficiency of pancreatic secretion.

Heyn's results tend to show that considerable reliance may be placed on these methods. Low unit values with both the Wohlgemuth and Fuld-Gross methods alike seem to point to a pancreatic obstruction or insufficiency

Diagnosis of Pancreatic Affections. In an investigation of the various methods of determining the functional activity of the pancreas, A. Werzberg⁷ undertook to determine the specificity of the Gross-Fuld method of determining the presence of trypsin in the feces by the digestion of casein. His technic was as follows:

1. 0.2 of casein renania and 0.2 of sodium bicarbonate are dissolved in 200 c.c. of distilled water. The soda water was first warmed to a temperature of from 50° to 60° C. in a thin glass beaker, and the casein dusted into the beaker. By constant stirring with a glass rod fitted with rubber tubing at the end the casein was allowed to boil for a minute and then the mixture was filtered. The solution so obtained was clear without any opalescence. In order to determine immediately whether the casein was actually dissolved a control was carried out in which 2 c.c. of the solution was mixed in a test-tube with 0.3 c.c. of 1-per-cent. acetic acid, and there occurred immediately a very pronounced turbidity or precipitate.

2. The feces were extracted with 1-per-cent. soda solution in the proportion of one part to ten, and filtered repeatedly until the extract became a quite clear, transparent, more or less yellowish liquid.

3. In a series of test-tubes were placed 10 c.c. of the casein solution in each, and to it added 1.0 — 0.8 — 0.5 — 0.3 — 0.1 of the extract of feces. After repeated shaking and the addition of 0.5 of chloroform the tubes were placed in a rack in a thermostat at 37° C., and after remaining for various periods of time from the beginning of the experiment they were examined for trypsin. The quantity, 10 c.c. of the casein solution, was selected because as for each trypsin test only 2 c.c. of the entire liquid (casein-solution + feces-extract + chloroform) were used and the same with the control test of the casein solution itself, the amount of the mixture in each test-tube would be sufficient for five tests.

As the result of his investigations the author reaches the following conclusions:

1. The casein test may be regarded as specific for the determination of the function of the pancreas or of the presence of pancreatic trypsin.

(7) Archiv. f. Verdauungskr., Bd. 17, H. 5, Google

2. The diastatic ferment is secreted both by the pancreas and the mucous membrane of the intestine. Whether a decisive rôle is to be ascribed to this ferment in the diagnosis of pancreatic disease must be the subject of further investigation.

3. The significance of lipase for the establishment of the existence of pancreatic disease is at the present time still undetermined.

Deaver⁸ makes the following remarks concerning the means of diagnosis of pancreatic disease: Disturbance of the internal secretions of the pancreas is rarely of any assistance in the diagnosis of pancreatitis, as the islands of Langerhans are the last of the glandular elements to suffer. He has seen slight temporary glycosuria during exacerbations. The digestive function, however, is interfered with, manifesting itself by loss of weight and the evidence in the stools of imperfect digestion. The stools are usually bulky and light in color from the presence of fat and fatty acids. This is true even when bile is being plentifully discharged into the intestines, as is shown by positive tests for stercobilin. Undigested muscle fibers are also commonly found after a meal containing meat.

From the much debated Cammidge reaction of the urine, after a considerable experience Deaver is obliged to confess that he has not derived much benefit. From the fact that Robson, Moynihan and Cammidge still maintain and are able to bring clinical evidence to support its value, he believes it is of some importance, but certainly as the test is performed in the majority of our laboratories it does not pay the clinician to place too much reliance on it.

Gastric analyses were made in 16 out of 30 cases. In 13 there was a subacidity; in 1 a hyperacidity, and in 2 the acid content was normal. There is no help here.

To detect the nuclei in the fibers of meat E. C. van Leersum⁹ mixes the stools with a large quantity of water and sets it aside in a small vessel. When the heavier particles have settled out the supernatant fluid is decanted into another vessel. The vegetable fibers then gradually settle to the bottom and the fluid above con-

(8) Long Island Med. Jour., March, 1911.
(9) Münch. med. Wochenschr., Feb. 6, 1912.

tains merely the meat fibers and fine detritus. Repeating this sedimentation process the sediment finally contains most of the meat fibers in the stool and their amounts can be estimated and the nuclei stained and examined, to determine the extent of pancreatic digestion. Van Leersum has thus obtained an abundant sediment consisting almost exclusively of meat fibers in cases of diarrhea and in a case of pancreatitis.

Disturbances of Internal Secretion in Pancreatic Disease. M. Cohn and H. Peiser¹ report examinations of the internal secretions in 5 cases of pancreatic disease, 3 cases of acute hemorrhagic pancreatitis, and 1 each of purulent pancreatitis and of chronic interstitial pancreatitis. They found the following symptoms indicating disturbance of internal secretion: More or less exophthalmos in four cases, Graefe's sign in four cases; the signs of Moebius and Stellwag in five cases; tremor and dermatography in five cases, a relative lymphocytosis in four cases, an increase of phloridizin glycosuria in five cases, and Kocher's sign in five cases. The number of cases so far investigated they regard as too small to draw any definite conclusion from.

Fat Necrosis and Pancreatic Disease. H. M. Richter² discusses the conditions under which fat necrosis is produced and concludes as follows: It would seem that the escape of duodenal contents into the peritoneum would satisfy all the requirements for the production of fat necrosis. The pancreas secretion would escape freely; moreover, it would be accompanied by bile, which has been shown to increase the lipolytic action of the pancreatic ferments. Yet he can find no case recorded in which fat necrosis accompanied perforation of the duodenum. He reports a case in which the accident occurred. There have been reported in the literature of fat necrosis several cases in which the pancreas has been free from gross changes, but which could be accounted for on the assumption of duct obstruction, with escape of pancreatic secretion without extensive changes in the pancreas. One case has, however, been reported that has been rather widely quoted, in which there was extensive fat necrosis with no lesion, gross or microscopic, of the

(1) Deutsche med. Wochenschr., Jan. 11, 1912.

(2) Northwestern Univ. Med. School Bull., December, 1910.

pancreas, or of its duct, or of the gall-tracts. Opie suggested that it might have been caused by disease of an accessory pancreas.

In a paper on the histology of fat necrosis, Berner (Virchow's Archiv f. path. Anat., 1907, CLXXXVII, 360) includes among six cases of fat necrosis that he reports, one in which the lesion was caused by a perforation of the ileum two and one-half meters below the pylorus, and one in a case of rupture of the bowel above a strangulated femoral hernia.

Richter determined to attempt to reproduce the condition in the dog. He succeeded in one case out of seven. The rarity of fat necrosis in clinical experience in perforations of the intestinal wall seems to be paralleled by the remarkable inconstancy in the results of experimental work.

MISCELLANEOUS.

PAROXYSMAL HEMOGLOBINURIA.

O. Berghausen³ draws the following deductions from experimental work in reference to the rôle of acidosis of the tissues as a factor in the production of an attack of paroxysmal hemoglobinuria. In the experiments it was noticed that the corpuscles of patients suffering from paroxysmal hemoglobinuria were somewhat less resistant to an atmosphere of carbonic acid gas as compared with corpuscles from a normal individual. This difference was not very marked, however; the chief difference lies in the blood-serum of the patient.

Contrary to the findings of Hymans, it was found that normal corpuscles in normal salt water suspension were also, although more slowly, hemolyzed in an atmosphere of carbonic acid gas. Sodium citrate solution, of a strength of 1.5 per cent., was sufficient to prevent hemolysis of both the patient's and normal human corpuscles in an atmosphere of carbonic acid gas at room temperature. Apparently the salt concentration of the blood-serum is the factor which determines whether the corpuscles shall be hemolyzed or not. As shown above,

(3) Archiv. Int. Med., Feb. 15, 1912.

normal serum has sufficient salt dissolved to prevent hemolysis of both the patient's and normal corpuscles in an atmosphere of CO_2 at room temperature.

Krokiewicz states that inactivated (55°C.) serum from a hemoglobinuric patient no longer hemolyzes the patient's corpuscles in an atmosphere of CO_2 , after fresh human serum is added as complement. By adding this serum he merely increased the salt concentration of the serum which previously was poor in salts.

The paroxysmal attacks have been variously ascribed to the action of cold, congestion and trauma, locally or remotely produced. It would appear that changes locally in the tissues must be necessary before a state of hemoglobinemia or hemoglobinuria can be produced. In view of the fact that cold, trauma and passive congestion may all lead to an attack, and since the three conditions are associated with the production of an excessive acidity of the tissues, it is not unreasonable to suppose that the organic acids thus formed, play some part directly in the production of the attacks. The corpuscles may be less resistant, they may be subject to the action of a specific hemolysin, and yet an additional factor acting locally in the tissues seems necessary for an attack to be produced. In the presence of proper salt concentration, the corpuscles are protected against the hemolytic action of any organic acids. This naturally suggests the giving of neutral salts as a therapeutic agent, to prevent the onset of attacks in patients suffering from paroxysmal hemoglobinuria.

DISEASE OF THE PERITONEUM.

Sensibility of the Peritoneum. J. F. Mitchell⁴ discusses the question of sensibility to pain of the abdominal viscera and of the peritoneum. He cites the work of Lennander and of Nyström as showing that the viscera are insensitive, while the parietal peritoneum is markedly sensitive. Lennander's theory is expressed as follows: Pains do not originate within the abdominal organs themselves. Irritation of an abdominal organ first gives rise to pain when it has extended to the sensitive tissue

(4) Jour. Amer. Med. Assoc., Aug. 26, 1911.

outside this organ. Pain then exists through an irritation of the parietal peritoneum. This may be mechanical as in volvulus, chemical as in absorption from an ulcer, or infectious, as by means of a lymphangitis in appendicitis, or the direct expulsion of contents from gall-bladder, stomach or intestine. Viscera involved in disease are quite as insensitive as sound ones, while the irritability of the parietal peritoneum is much increased by even a slight inflammation.

Innumerable tests made by surgeons at the operating table have shown that operative procedures may be painlessly carried out on practically any abdominal organ, provided the parietal peritoneum is avoided. Through gastric or intestinal fistulæ the mucous membrane has been tested and has likewise been found to show no perception of touch, heat, cold or pain. Zimmermann, in 1909, reported an extensive series of experiments on himself and on patients in which the mucous membrane of the stomach and of the rectum was examined without the employment of any anesthetic. Through a stomach-tube or a rectal speculum the mucous membrane was irritated by the means of pinching forceps, electrodes and the cautery. In the rectum above 6 cm. from the sphincter there was no response to touch, temperature, or electric stimulation; but great differences in pressure were felt. In the stomach likewise he got no response, and here also there was only a sensation of fulness on great pressure. The esophagus was found sensitive to pressure and temperature, thus accounting for the sensation of warmth on taking hot or alcoholic drinks. This is in accord with the conclusions reached by Hertz, Cook and Schlesinger. Neumann on the other hand found the stomach in women very sensitive to differences in temperature. Lennander asserted that a gastric ulcer remains painless so long as it is not accompanied by a lymphangitis; that the pains of hyperacidity are also due to absorption by which irritating toxic or chemical substances are carried to the sensitive tissue of the abdominal wall. Müller regards the internal organs as sensitive to certain irritations from which they need to be protected such as hyperacidity, undue pressure, etc. This sensibility he at-

tributes to the sympathetic nerves, which, though ordinarily not transmitting pain impulses, may do so under abnormal or diseased conditions.

The ideas of Lennander were contradicted by Kast and Meltzer. Their principal method of examination was to open the abdomen under ether narcosis and to close the wound by means of temporary sutures, the animal then being allowed to regain consciousness thoroughly, when one or more of the sutures were cut and tests made through a very small opening. They concluded that the abdominal organs of dogs examined through a small opening are undoubtedly sensitive; that this sensibility rapidly decreases on exposure or withdrawal of the viscera, but increases again after exposure long enough to produce inflammation. They explained the results of Lennander by the fact that first the examinations were made through a large opening, and second, that they were all made during operations under local anesthesia.

Their experiments were repeated by Müller who obtained exactly opposite results. Ritter, on the other hand, verified the conclusions of Kast and Meltzer. He assails Lennander's findings. He bases his opinion on animal experimentation under morphine narcosis, agrees in general with Kast and Meltzer, and believes that the sympathetic nerves transmit sensory impulses. An entirely new principle is introduced in his experiments, associating visceral sensation directly with the blood-supply. The ligation of bloodvessels, he says, is the only means of testing which eliminates all possibility of error. He finds this painful in every instance. Mesenteric tug he eliminates by means of double ligation, the proximal ligature always causing pain, but the distal ligature only when it is applied first. All parts of the abdomen are thus sensitive, non-vascular parts less so than those rich in bloodvessels. The vessels themselves are most sensitive. Cocaine acts only as a local anesthetic in the abdomen, and when applied about mesenteric vessels renders anesthetic the viscera supplied by them. Ritter believes the negative findings reported by surgeons to be due, not to cocaine, but to the injury which the laparotomy does to the finer sensible nerve fibers in the

abdominal cavity. This injury is important in the production of shock. He thinks it therefore wise when working in the abdomen under local anesthesia, to cocaineize every vessel of any size before ligating it.

Mitchell's own observations indicate the contrast between the sensibility of the parietal peritoneum and that of the visceral. With reference to the statement of Kast and Meltzer that surgical experiences on men offer no proof that the viscera of normal man in the normal closed body can feel no pain he says: "While this is naturally a hard condition to answer, it has seemed to me that much might be learned by the careful analysis of all abdominal pains in patients about to be subjected to laparotomy. It has, therefore, been my custom for the past few years to write down the findings before operation, and make also a written prediction as to what was to be expected on opening the abdomen. A comparison of these predictions with the operative findings has given interesting results in support of the marked contrast between visceral and parietal peritoneal involvement. Many referred pains may be explained by the relation of the involved organ to the parietal peritoneum. Thus the first pain of an acute appendicular attack is most often located in the epigastrium. Time and again I have found with the abdomen open under local anesthesia that this pain could be accurately reproduced by traction on the mesentery of the appendix. The pain is, under these circumstances, accompanied by nausea, just as is so often seen in irritating the neck of a hernia sac. While doing a cocaine appendectomy on a physician, I obtained his consent to some tests, the nature of which he did not know. He was anxious to watch the operation and see his appendix in place, and so was allowed to have his head raised for this purpose. The appendix presented readily at the opening in his unusually thin abdominal wall. It was clamped across, and caused no inconvenience. Then, by making traction on the mesentery, I could at will cause him to sink back with marked pallor, nausea, and complaint of violent pain in the epigastrium, which he described as "my old friend." These phenomena disappeared when the mesentery was released, and he was able to watch the com-

pletion of the operation. In a case of gall-bladder fistula with total occlusion of the cystic duct, as shown by a later operation, I was able, by injecting into the gall-bladder hydrogen peroxid and placing a finger over the fistula, to cause the typical pain of gall-stone colic. The man complained of agonizing pain about the right shoulder blade, which immediately disappeared when the finger was removed from the opening. I believe this pain to have been caused by traction of the distended gall-bladder on the posterior peritoneum, and not by the mere distention itself; for a probe introduced into the gall-bladder and pushed with some force against its walls did not cause discomfort."

In acute conditions the findings are quite as constant. True muscle spasm is always due to inflammation of the anterior and lateral parietal peritoneum, and it is possible to make out accurately the extent of this involvement. While there may be some resistance to pressure on deep palpation in centrally located lesions, true protective muscle spasm comes only from inflamed parietal peritoneum. By the character and amount of pain and by the resistance to palpation, it is possible to tell before operation whether the lesion will be found deeply situated, as between omentum and intestinal coils, or directly against the parietes.

Without denying the usefulness of animal experimentation in this particular field, Mitchell insists that its results cannot outweigh the mass of surgical evidence. He agrees with Nyström that, while there are some weak points in Lennander's hypotheses they appear to give a more rational explanation of the phenomena of abdominal pain than does the theory depending on an imaginary pain-carrying power of the sympathetic nerves.

The Coin-Sound in Ascites. Ch. Lesieur and J. Rebattu⁵ have applied the well known coin-sound to the examination of the abdomen for ascites. This sign is based on the principle that if a sound such as that made by striking a coin is transmitted by a homogeneous medium such as a liquid the sound will be clear and sharp, but if there exists between the point which is struck and the point at which one listens a succession of layers of

(5) Lyon Méd., Aug. 6, 1911.

tissue of different composition, some of them areolar and poor conductors of sound vibration and the others homogeneous and good conductors, the modification of the transmitted sound is determined by the bad conductors, and the sound reaches the ear dull and muffled, a wooden sound. Having applied this method to the examination of cases of ascites the authors have found that in a number of cases they were able to make a diagnosis when it would have been impossible by other means.

Pseudochylous Ascites. F. P. Henry⁶ reports a case of pseudochylous ascites and necropsy in which there was shown a neoplasm embracing the pylorus, the head of the pancreas and the bile ducts. The growth proved to be a carcinoma of the pylorus. There was no enlargement of the abdominal lymph-nodes or distention of the lymphatic channels. There was no disease of the liver. It is possible that the abdominal effusion was caused by compression of the portal vein by the pyloric tumor.

This case does not stand alone in so far as the absence of the usual causes of ascites are concerned. In many of the recorded cases, neither portal obstruction, nor peritoneal inflammation was detected. The mere presence of carcinoma, and especially carcinoma of the stomach seems to be of etiologic influence in the production of pseudochylous ascites. The carcinoma of the stomach was, of course, suspected during the patient's lifetime, but the almost complete absence of vomiting did not seem to warrant its location in the pylorus. The comparatively high blood count (3,510,000) about a week before death, taken in connection with the profound cachexia, is of interest and is corroborative of views expressed many years ago by Henry in connection with the differential diagnosis between pernicious anemia and latent gastric carcinoma. As then pointed out the number of red blood cells per cubic millimeter rarely descends below 3,000,000, while in pernicious anemia it is generally below 1,000,000. A pernicious anemia patient with less than 20 per cent. of the normal number of red cells may be able to walk long distances, while a patient with gastric carcinoma with a count of 3,500,-

(6) N. Y. Med. Jour., July 1, 1911.

000 red cells may be scarcely able to sit up in bed. As previously expressed: In pernicious anemia, the cachexia does not keep pace with the oligocythemia; in gastric cancer the oligocythemia does not keep pace with the cachexia.

DISEASES OF THE ABDOMEN.

J. Phillips⁷ reviews the diagnosis of acute conditions of the upper abdomen. The examination should include all the organs of the body, and the examiner should especially bear in mind the following conditions:

1. Disease of the gall-bladder and ducts, cholecystitis, cholelithiasis, catarrhal jaundice.
2. Appendicitis.
3. Diseases of the liver, liver abscess, hepatitis.
4. Diseases of the stomach and duodenum, acute dilatation, gastritis, perforation of a gastric ulcer, stenosis of the pylorus, perforation of a duodenal ulcer.
5. Colitis.
6. Gastric or hepatic crises of tabes.
7. Hemorrhage into the pancreas or acute pancreatitis.
8. Intestinal obstruction from various causes.
9. Epigastric hernia.
10. Hemorrhage into the suprarenals.
11. Lead colic.
12. Renal colic, pyelitis and ureteritis, Dietl's crises.
13. Arteriosclerosis of the abdominal vessels.
14. Thoracic disease—pneumonia, pleurisy, pericarditis, angina pectoris, caries of the thoracic vertebræ and conditions in the posterior mediastinum with irritation of the splanchnic nerves.

The symptoms of *acute cholecystitis* in some cases may be of such mild character that the condition is looked upon as indigestion. That cholecystitis occurs much more frequently than our clinical diagnosis would indicate is shown by the frequent finding at operation or necropsy of adhesions between the gall-bladder, stomach and colon. One should not forget that the two conditions, cholecystitis and appendicitis, may be present

(7) Cleveland Med. Jour., December, 1911.

at the same time. As a rule there is tenderness with some rigidity in the region of the gall-bladder. The right rectus muscle in the upper part may be held so tense that it simulates a tumor. In cases where the inflammation is slight the tenderness can best be elicited by a sudden firm pressure over the ribs in the region of the gall-bladder. A very common tender point is at the junction of the upper two-thirds with the lower third of a line drawn from the ninth rib to the umbilicus. The history and finding of bile in the urine will frequently clear up the diagnosis. The temperature in cholecystitis varies as a rule with the severity of the inflammation.

In many cases the pain of gall-stone colic is so excruciating and so characteristic that the diagnosis is easily made, but this is not always the case. Ordinarily the pain is felt in the region of the gall-bladder, radiates to the back and right shoulder, or downwards toward the umbilicus. Cholecystitis often accompanies biliary colic, but the latter, when it exists alone, can be distinguished from the former by the greater severity of the pain, the absence of fever, leukocytosis and tumor. In cases of gall-stones associated with cholecystitis, perforation may occur with local or general peritonitis. Another complication that may arise in these cases is erosion of a blood-vessel with fatal hemorrhage.

Usually the symptoms and physical signs in *catarrhal jaundice* are not marked. Occasionally there is quite severe vomiting at the outset and sometimes tenderness of the liver, but beyond these, there is nothing suggesting an acute abdominal condition. These cases are often looked upon as indigestion until the finding of bile in the urine or the presence of jaundice reveals the error. In children especially one should keep in mind the fact that an acute catarrhal jaundice may be the beginning of an acute yellow atrophy of the liver.

Acute appendicitis may simulate acute conditions of the upper abdomen where in the course of development the appendix has failed to descend so that it lies under the right lobe of the liver where it is retrocecal in position or where it is unusually long and its free tip passes upwards towards the duodenum and pylorus. In cases where the appendix passes upwards behind the ascending

colon, the pain may be felt above the umbilicus and well out into the flank, simulating pyelitis. Rigidity of the muscles and local tenderness is not felt at McBurney's point but just beneath the right costal margin and well out into the flank. These two conditions, however, may occur together. In cases where the tip of the appendix points upward, chronic inflammation of the organ may simulate a gastric or duodenal ulcer or gall-stones.

Acute hepatitis is rarely seen in this country but it is not uncommon in the tropics. The symptoms are the same as in cases of congestion of the liver but the vomiting is more marked, the pain in the shoulder is more severe, and the temperature is raised. The upper part of the abdomen is rigid, and the liver is enlarged and tender. If a perihepatitis is present the descent of the diaphragm is very painful.

In rare cases *abscess of the liver* may give rise to no symptoms, the condition being discovered at necropsy. Usually the patient complains of general weakness, sweating, recurring chills and a feeling of fullness and tenderness in the right hypochondrium. In some cases there is considerable pain, either constant or intermittent, in the region of the liver and referred to the right shoulder. The temperature varies from normal in the morning to 103° F. or more in the afternoon. Digestive disturbances in the form of vomiting, losses of appetite, and diarrhea are common. Loss of flesh is progressive. The patient lies on his back or on his right side because this position is more comfortable. In the majority of cases, jaundice of a mild degree is noted. The respirations are shallow because movement of the diaphragm causes pain. The lower lobe of the right lung is compressed, so that liver abscess may simulate pneumonia or empyema. The lower part of the right side of the chest and the upper part of the abdomen on the same side may show considerable bulging. Sometimes succussion associated with a great deal of pain can be elicited. The liver dulness in its upper part may be dome-shaped, and extend as high as the third rib. If a perihepatitis is present friction can be felt over the liver.

The diagnosis in cases of *amebic abscess* may be con-

firmed by the finding of amebæ in the stools or by puncture of the liver.

Acute Dilatation of the Stomach. In this condition the chief symptoms are profuse pain and persistent vomiting of large quantities of brownish fluid, pain in the epigastrium, abdominal distention and tenderness, great thirst and rapid collapse. Inspection often shows the outlines of the distended stomach which disappear partly after vomiting. Percussion shows replacement of the gastric tympany by flatness. The most important diagnostic sign is the removal of excessive quantities of fluid by the stomach-tube. Though a great deal has been written about acute dilatation of the stomach in adults, very meager indeed are the reports of this condition in children. The youngest case mentioned by Conner was that of a child three years of age. This condition is not so uncommon in children under two years of age and is one of the causes of sudden death. Phillips reports a case in a child aged five months.

Acute gastritis, whatever may be the cause, may give rise to very severe abdominal symptoms with marked prostration, pallor, pain in the epigastrium and severe vomiting. The appropriate correlation of the history and physical findings will usually make the diagnosis simple.

The first sign of *perforation of a gastric or duodenal ulcer* is severe pain in the epigastrium. This may follow the taking of a heavy meal or some strain such as vomiting or bodily exercise. As a rule the history is very important as the characteristic symptoms of ulcer of the stomach or duodenum can be obtained. In a few cases perforation is not preceded by any symptoms of digestive disturbances. Severe prostration and collapse soon supervene. On physical examination the signs are those of a localized peritonitis of the upper abdomen, tenderness, rigidity of the recti muscles and diminished mobility. Later there is increasing distention with obliteration of the liver dulness, though the latter sign is unreliable. If the perforation has occurred on the posterior wall of the stomach, the pus collects in the lesser peritoneal cavity, adhesions may close off the foramen of Winslow, and in that way prevent a general peritonitis.

Acute colitis often gives rise to very severe pain in the upper abdomen with extreme tenderness and rigidity of the abdominal muscles. The colicky nature of the pain, the severe tenesmus with the frequent bowel movements containing mucus and sometimes blood, the fact that there is usually marked tenderness in the region of the cecum and the sigmoid flexure of the colon will serve to establish a correct diagnosis.

In tabes, *gastric crises* are not uncommon. In these attacks the patient suddenly suffers from severe vomiting, projectile in character and often unassociated with nausea. The pain is usually quite severe, and is often girdle-like in character. The vomitus first contains food, then clear fluid and finally bile. There is often great prostration with faintness, vertigo and a rapid, feeble pulse. The attacks last for hours or for several days and return at irregular intervals. Usually the inactive pupils and loss of reflexes give a clue to the cause of the vomiting, but in a few cases the gastric crises occur before the loss of tendon reflexes can be detected, and the diagnosis from acute abdominal conditions may be very difficult indeed.

Acute hemorrhagic pancreatitis is a disease seldom diagnosed during life, the diagnosis in the majority of cases being that of intestinal obstruction. One of the most characteristic features is the suddenness of the onset with excruciating pain due no doubt to the swelling and filtration of the pancreas involving the semilunar ganglia. Nausea and severe vomiting occur, and these are associated with symptoms of collapse. Sometimes there is a chill and following this the temperature rises often to 104° or 105° F. There are signs of a local peritonitis in the upper part of the abdomen and occasionally a tumor can be felt above the umbilicus, though this is usually obscured by the rigidity of the recti muscles. Fitz said that acute pancreatitis is to be suspected when a previously healthy person or a sufferer from occasional attacks of indigestion is suddenly seized with a violent pain in the epigastrium followed by vomiting and collapse, and in the course of 24 hours by a circumscribed epigastric swelling, tympanitic or resistant, with slight elevation of temperature. Circumscribed tenderness in

the course of the pancreas and tender spots throughout the abdomen are valuable diagnostic signs.

Intestinal obstruction may be classified as, follows:

(a) Obstruction of the lumen of the bowel from masses of fecal matter, gall-stones, intestinal concretion and parasites, foreign bodies such as fruit stones and masses of vegetables or animal fibers or hairs. (b) Disease of the wall of the bowel, as in simple cicatricial stenosis following a syphilitic or tuberculous ulceration, or where tumors, either simple or malignant, involve the wall of the bowel. (c) Compression of the bowel from tumors of neighboring organs. (d) Strangulation from bands of adhesions, vitelline remains, omental or mesenteric slits, peritoneal pouches, and the incarceration of internal herniæ. Among the latter may be mentioned the diaphragmatic herniæ, hernia from the foramen of Winslow, hernia of the intersigmoid recess, of the paracecal peritoneal pockets, of the duodeno-jejunal and duodenal recess (the so-called Treit's hernia). (e) Volvulus. (f) Intussusception. In regard to intussusception it is necessary to emphasize the importance of the history in diagnosis. This is especially true in cases of intussusception in children. A healthy child at play may suddenly scream with pain and turn and twist in agony so that the mother will say that she knows something dreadful has happened. The pain may keep up continuously or it may subside to recur again in a few minutes or hours. If an enema is given some mucus and blood returns with the stool. On careful examination, if necessary under an anesthetic, the characteristic tumor may be made out. Rectal examination should never be omitted in this or any other abdominal condition. Cases of chronic intussusception sometimes occur and the diagnosis here can often be made from the fact that the tumor changes its form from day to day.

Epigastric herniæ are not frequent. They are usually small herniæ of the omentum situated above the umbilicus, slightly to one side of the median line, and form a small tumor, varying in size from a cherry to a walnut. Occasionally they are very large. The usual symptoms complained of are pain, often of a dragging char-

acter, and nausea and vomiting. These herniæ may become acutely inflamed, as in one patient whose feet slipped while he was cranking his automobile and the crank struck him in the epigastrium. The inflammation of the hernia that resulted made operation necessary.

Quite a number of cases of *hemorrhage into the adrenal bodies* have been described. Death usually occurs within 48 hours. The most characteristic symptoms are sudden pain in the upper part of the abdomen, fever and vomiting, with convulsions and diarrhea. The abdomen early shows marked rigidity with increasing distention. The patient almost from the onset shows signs of collapse.

The abdominal symptoms in *lead poisoning* may closely simulate a general peritonitis or local inflammatory condition such as acute appendicitis or cholecystitis. It is very important therefore in any case of abdominal pain to question the patient carefully in regard to his occupation and never forget to look for the "lead line" on the gums.

In *renal colic*, pain of extreme violence is felt in the lumbar region of the affected side. The pain is associated with muscle spasm which causes the patient to double up and frequently to get on his hands and knees. The pain radiates downward and inwards towards the groin, scrotum and testicle, causing marked retraction of the latter. Sometimes there is vesical irritability with frequency of urination. There may be severe systemic depression with chills, fever, rapid pulse, pallor and vomiting. During and after an attack red blood-cells can be found in the urine. An *x-ray* examination will usually confirm the diagnosis.

Pyelitis, the most common of which is a colon bacillus infection, is not uncommon in the female, and is occasionally seen in the male. The most important symptoms are chills, associated with dull pain and tenderness in the region of the kidneys. Fever, malaise, sweats and digestive disturbances are constantly present. The careful examination of the urine with the finding of pus and bacteria will clear up the diagnosis. In this connection it should be emphasized that pyelitis is a very common cause of unexplained high temperature in girl ba-

bies. The diagnosis can always be made if one remembers to use a catheter. In children the symptoms sometimes suggest an involvement of the meninges, as the child will often lie in a stupor with slight rigidity of the neck muscles.

In *floating kidney*, Dietl in 1864 described attacks characterized by severe abdominal pain, chills, nausea, vomiting, fear and collapse. These attacks may be mistaken for renal colic or appendicitis.

Of recent years much attention has been paid to painful gastric and intestinal conditions which are supposed to be associated with *spasm of the gastric and mesenteric vessels*. The pain in these cases is often worse at night so that the patients may always go to bed with a hot water bottle on the abdomen, and the condition is sometimes associated with nausea, vomiting and meteorism. Sometimes in these cases thrombosis of the mesenteric vessels occurs with symptoms of intestinal obstruction.

Thoracic Disease. Every clinician is familiar with the fact that in pneumonia, pleurisy and pericarditis the pain is often referred to the abdomen. This is particularly true of pneumonia associated with a diaphragmatic pleurisy, and numerous cases have been recorded where these cases have been operated on, the diagnosis of appendicitis having been made. In angina pectoris, too, the pain is sometimes referred to the abdomen. In caries of the thoracic vertebræ below the sixth, or in aneurism of the lower part of the descending aorta intense pain and rigidity may be felt in the abdomen. Phillips reports a case of rupture of the descending thoracic aorta in which the symptoms and physical signs suggested acute general peritonitis.

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